



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>

3 804,086



M

M

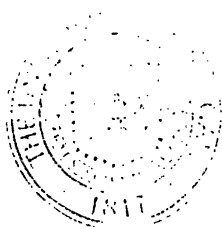


M

M



M



37



Library
T
1
834
921

The Franklin Institute

OF THE
STATE OF PENNSYLVANIA

TRANSPORTATION LIBRARY

1921 YEAR BOOK

UNIVERSITY OF MICHIGAN LIBRARIES

NOW READY

the Physics of the Air

By **WILLIAM J. HUMPHREYS, Ph.D.**

Professor of Meteorological Physics
United States Weather Bureau

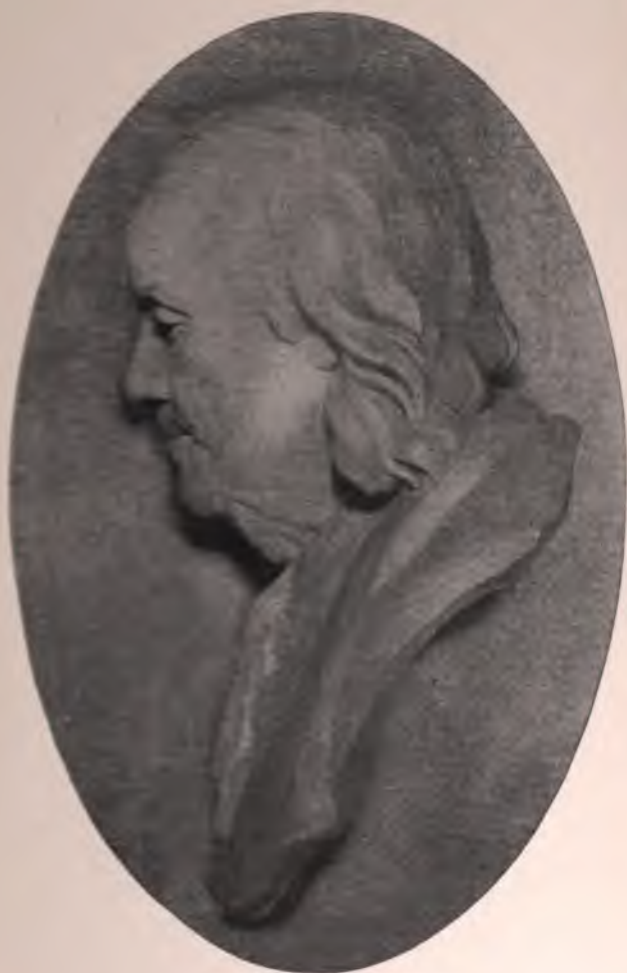
A rational and deductive treatise on the
physics of the atmosphere. Of great value
to meteorologists, physicists and the aviator.

678 Pages, Illustrations, Index, 8vo.

Price, \$5.00
Carriage extra.

Address orders and inquiries to

THE FRANKLIN INSTITUTE
PHILADELPHIA, U.S.A.



BENJAMIN FRANKLIN

VENERATED FOR BENEVOLENCE, ADMIRER FOR TALENTS, ESTEEMED
FOR PATRIOTISM, BELOVED FOR PHILANTHROPY.

—(*Washington.*)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

FOUNDED 1824

Year Book—1921

PHILADELPHIA

HALL OF THE INSTITUTE

15 SOUTH SEVENTH STREET

SEPTEMBER 1, 1921

Office
Library
T

= 33-7

TELEPHONES

Bell, . Market 2373, 2374
Keystone, . Main 6641

CONTENTS

| | PAGE |
|---|------|
| OFFICERS AND COMMITTEES, 1921 | 5 |
| PAST OFFICERS, 1824-1921 | 10 |
| PAST CHAIRMEN, COMMITTEE ON SCIENCE AND THE ARTS, 1834-1920 . . . | 16 |
| THE INSTITUTE'S ACTIVITIES | 17 |
| SOME INSTANCES OF THE INSTITUTE'S WORK | 24 |
| CHARTER AND BY-LAWS | 28 |
| AWARDS BY THE INSTITUTE | 43 |
| REGULATIONS OF THE COMMITTEE ON SCIENCE AND THE ARTS | 49 |
| ANNUAL REPORTS | 59 |
| THE FRANKLIN INSTITUTE AWARDS, 1920-'21 | 82 |
| FRANKLIN INSTITUTE AWARDS, 1856-1921 | 86 |
| TERMS AND PRIVILEGES OF MEMBERSHIP | 126 |
| MEMBERSHIP DIRECTORY | 127 |

OFFICERS AND COMMITTEES, 1921

PRESIDENT

WALTON CLARK

VICE-PRESIDENTS

COLEMAN SELLERS, JR.

CHARLES DAY

HENRY HOWSON

SECRETARY

R. B. OWENS

TREASURER

BENJAMIN FRANKLIN

BOARD OF TRUSTEES

....., President

W. L. AUSTIN

JOHN GRIBBEL

CHARLES E. BRINLEY

ALFRED C. HARRISON

WALTON CLARK

FREDERICK ROSENGARTEN

BOARD OF MANAGERS*

GELLERT ALLEMAN

CHARLES A. HEXAMER

CHARLES E. BONINE

GEORGE A. HOADLEY

FRANCIS T. CHAMBERS

HARRY F. KELLER

G. H. CLAMER

ROBERT W. LESLEY

THEOBALD F. CLARK

EDW. V. McCAFFREY

W. C. L. EGLIN

MARSHALL S. MORGAN

WALTON FORSTALL

LAWRENCE T. PAUL

BENJAMIN FRANKLIN

JAMES S. ROGERS

ALFRED W. GIBBS

GEORGE D. ROSENGARTEN

ALFRED C. HARRISON

E. H. SANBORN

NATHAN HAYWARD

C. C. TUTWILER

GEORGE R. HENDERSON

WILLIAM CHATTIN WETHERILL

LOUIS C. ROBINSON, *Actuary*

*The President, Vice-Presidents, Secretary, Treasurer and the Chairman of the Committee on Science and the Arts are ex-officio members of the Board of Managers.

SOLICITORS

BROWN & WILLIAMS

COMMITTEES OF THE BOARD OF MANAGERS

COMMITTEE ON ELECTION AND RESIGNATION OF MEMBERS

ROBERT W. LESLEY, Chairman
GELLERT ALLEMAN

ALFRED W. GIBBS
MARSHALL S. MORGAN

COMMITTEE ON ENDOWMENT

COLEMAN SELLERS, Jr., Chairman
G. H. CLAMER
ALFRED C. HARRISON

NATHAN HAYWARD
WILLIAM C. WETHERILL

EXECUTIVE COMMITTEE

E. H. SANBORN, Chairman
CHARLES DAY
WALTON FORSTALL

ALFRED W. GIBBS
ALFRED C. HARRISON

COMMITTEE ON EXHIBITIONS

BENJAMIN FRANKLIN, Chairman.
FRANCIS T. CHAMBERS
THEOBALD F. CLARK

CHARLES DAY
CHARLES A. HEXAMER

FRANKLIN FUND AND BUILDING COMMITTEE

HENRY HOWSON, Chairman

WALTON CLARK, Treasurer
ALFRED C. HARRISON

COMMITTEE ON INSTRUCTION

LAWRENCE T. PAUL, Chairman
GEO. A. HOADLEY
HARRY F. KELLER

EDW. V. McCAFFREY
JAMES S. ROGERS

Officers of Instruction

Louis C. Robinson, Director
H. E. Barrett
John C. Bechtel
H. H. Blizzard
R. E. Brown
G. W. H. Fawkes
H. H. Fox
H. W. Howitz
Karl E. Klabe
Frederick Miller

James G. Morgan
W. Earl Neilson
B. A. Owen
William S. Owen
I. P. Pedrick
Clement Remington
A. J. Stretton
J. W. Thompson
B. B. Wood

COMMITTEE ON PUBLICATIONS

GEORGE D. ROSENGARTEN, Chairman

GEORGE A. HOADLEY

G. H. CLAMER

E. H. SANBORN

W. C. L. EGLIN

Editorial Staff of the Journal

R. B. OWENS, Editor

Associate Editors

Brig. Gen. James Allen

Ralph Modjeski

Joseph S. Ames

L. A. Osborne

Wilder D. Bancroft

Albert Sauveur

John J. Carty

Maj. Gen. Geo. O. Squier

A. S. Cushman

C. P. Steinmetz

A. S. Eve

S. W. Stratton

W. J. Humphreys

Chief Con. D. W. Taylor, U.S.N.

Harry F. Keller

R. S. Woodward

A. E. Kennelly

A. F. Zahm

Gaetano Lanza

COMMITTEE ON SECTIONAL ARRANGEMENTS

HARRY F. KELLER, Chairman

ROBERT W. LESLEY

GELLERT ALLEMAN

C. C. TUTWILER

GEORGE R. HENDERSON

COMMITTEE ON STOCKS AND FINANCE

WALTON FORSTALL, Chairman

JAMES S. ROGERS

BENJAMIN FRANKLIN

E. H. SANBORN

ALFRED C. HARRISON

COMMITTEES OF THE INSTITUTE**COMMITTEE ON LIBRARY**

H. J. M. CREIGHTON, *Chairman*
CHARLES E. BOXINE
GEORGE S. CRAMPTON
CLARENCE A. HALL
GEORGE A. HOADLEY
HARRY F. KELLER

MARSHALL S. MORGAN
PAUL SPENCER
GEORGE F. STRADLING
W. C. WETHERILL
ALFRED RIGLING, *Librarian*

COMMITTEE ON MEETINGS

GELLERT ALLEMAN, *Chairman*
CHARLES BASKERVILLE
G. H. CLAMER
ALLERTON S. CUSHMAN
GEORGE R. HENDERSON

JOSEPH S. HEPBURN
HERBERT E. IVES
A. E. KENNELLY
M. M. PRICE
GEO. D. ROSENGARTEN

COMMITTEE ON MUSEUM

A. E. OUTERBRIDGE, JR., *Chairman*
HUGO BILGRAM
ARTHUR L. CHURCH
CHARLES DAY
GEORGE A. HOADLEY

C. W. MASLAND
CHARLES PENROSE
H. H. QUIMBY
COLEMAN SELLERS, JR.

COMMITTEE ON SCIENCE AND THE ARTS

| | |
|---------------------------------|------------------------|
| CHARLES W. M. MASLAND, Chairman | HERBERT E. IVES |
| HENRY B. ALLEN | W. N. JENNINGS |
| JAMES BARNES | HARRY F. KELLER |
| GEORGE H. BENZON, JR. | GAETANO LANZA |
| HUGO BILGRAM | LIONEL F. LEVY |
| CARL P. BIRKINBINE | PAUL A. LEWIS |
| CHARLES E. BONINE | LEO LOEB |
| RICHARD P. BROWN | HIRAM S. LUKENS |
| HAROLD CALVERT | EDW. V. McCAFFREY |
| WILLIAM C. CARNELL | J. Y. McCONNELL |
| G. H. CLAMER | K. G. MACKENZIE |
| EDWARD L. CLARK | CHARLES PENROSE |
| THEOBALD F. CLARK | M. M. PRICE |
| THOMAS D. COPE | H. H. QUIMBY |
| GEORGE S. CRAMPTON | FRANK ROGERS |
| H. J. M. CREIGHTON | JAMES S. ROGERS |
| J. A. P. CRISFIELD | L. F. RONDINELLA |
| GEORGE S. CULLEN | J. M. RUSBY |
| P. T. DASHIELL | RICHARD C. SELLERS |
| W. C. L. EGLIN | JOHN P. B. SINKLER |
| OWEN B. EVANS | WILLIAM H. THORNE |
| BENJAMIN FRANKLIN | JOHN C. TRAUTWINE, 3RD |
| WALTER H. FULWEILER | C. C. TUTWILER |
| CLARENCE A. HALL | JAMES G. VAIL |
| NATHAN HAYWARD | FRANCIS R. WADLEIGH |
| GEORGE R. HENDERSON | J. M. WEISS |
| JOSEPH S. HEPBURN | WILLIAM C. WETHERILL |
| CARL HERING | ROBERT L. WOOD |
| GEORGE A. HOADLEY | |

Standing Sub-Committees**The Franklin Medal**

| | |
|---------------------------|--------------------|
| HARRY F. KELLER, Chairman | G. H. CLAMER |
| JAMES BARNES | H. J. M. CREIGHTON |

Literature

| | |
|--------------------------|------------------|
| THOMAS D. COPE, Chairman | L. F. RONDINELLA |
| BENJAMIN FRANKLIN | J. M. RUSBY |
| HARRY F. KELLER | |

New Subjects and Preliminary Examination

| | |
|------------------------------|---------------------|
| H. J. M. CREIGHTON, Chairman | GEORGE R. HENDERSON |
| CHARLES E. BONINE | LIONEL F. LEVY |
| GEORGE S. CRAMPTON | CHARLES PENROSE |
| BENJAMIN FRANKLIN | M. M. PRICE |
| NATHAN HAYWARD | JAMES S. ROGERS |



BENJAMIN FRANKLIN

FOR HIS WISDOM, ADMIRER FOR TALENTS, ESTEEMED
FOR HIS VIRTUE, BELIEVED FOR PHILANTHROPY.

—(Washington.)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

FOUNDED 1824

Year Book—1921

PHILADELPHIA

HALL OF THE INSTITUTE

15 SOUTH SEVENTH STREET

SEPTEMBER 1, 1921



BENJAMIN FRANKLIN

VENERATED FOR BENEVOLENCE, ADMIRER FOR TALENTS, ESTEEMED
FOR PATRIOTISM, BELOVED FOR PHILANTHROPY.

—(*Washington*)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

FOUNDED 1824

Year Book—1921

PHILADELPHIA

HALL OF THE INSTITUTE

15 SOUTH SEVENTH STREET

SEPTEMBER 1, 1921

Transportation
Library

T
:

.F834Y.

1721

TELEPHONES

Bell, . Market 2373, 2374

Keystone, . Main 6641

CONTENTS

| | PAGE |
|---|------|
| OFFICERS AND COMMITTEES, 1921 | 5 |
| PAST OFFICERS, 1824-1921 | 10 |
| PAST CHAIRMEN, COMMITTEE ON SCIENCE AND THE ARTS, 1834-1920 . . . | 16 |
| THE INSTITUTE'S ACTIVITIES | 17 |
| SOME INSTANCES OF THE INSTITUTE'S WORK | 24 |
| CHARTER AND BY-LAWS | 28 |
| AWARDS BY THE INSTITUTE | 43 |
| REGULATIONS OF THE COMMITTEE ON SCIENCE AND THE ARTS | 49 |
| ANNUAL REPORTS | 59 |
| THE FRANKLIN INSTITUTE AWARDS, 1920-'21 | 82 |
| FRANKLIN INSTITUTE AWARDS, 1856-1921 | 86 |
| TERMS AND PRIVILEGES OF MEMBERSHIP | 126 |
| MEMBERSHIP DIRECTORY | 127 |



OFFICERS AND COMMITTEES, 1921

PRESIDENT

WALTON CLARK

VICE-PRESIDENTS

COLEMAN SELLERS, JR.

CHARLES DAY

HENRY HOWSON

SECRETARY

R. B. OWENS

TREASURER

BENJAMIN FRANKLIN

BOARD OF TRUSTEES

....., President

W. L. AUSTIN

JOHN GRIBBEL

CHARLES E. BRINLEY

ALFRED C. HARRISON

WALTON CLARK

FREDERICK ROSENGARTEN

BOARD OF MANAGERS*

GELLERT ALLEMAN

CHARLES A. HEXAMER

CHARLES E. BONINE

GEORGE A. HOADLEY

FRANCIS T. CHAMBERS

HARRY F. KELLER

G. H. CLAMER

ROBERT W. LESLEY

THEOBALD F. CLARK

EDW. V. McCAFFREY

W. C. L. EGLIN

MARSHALL S. MORGAN

WALTON FORSTALL

LAWRENCE T. PAUL

BENJAMIN FRANKLIN

JAMES S. ROGERS

ALFRED W. GIBBS

GEORGE D. ROSENGARTEN

ALFRED C. HARRISON

E. H. SANBORN

NATHAN HAYWARD

C. C. TUTWILER

GEORGE R. HENDERSON

WILLIAM CHATTIN WETHERILL

LOUIS C. ROBINSON, *Actuary*

*The President, Vice-Presidents, Secretary, Treasurer and the Chairman of the Committee on Science and the Arts are ex-officio members of the Board of Managers.

SOLICITORS

BROWN & WILLIAMS

COMMITTEES OF THE BOARD OF MANAGERS

COMMITTEE ON ELECTION AND RESIGNATION OF MEMBERS

ROBERT W. LESLEY, Chairman
GELLERT ALLEMAN

ALFRED W. GIBBS
MARSHALL S. MORGAN

COMMITTEE ON ENDOWMENT

COLEMAN SELLERS, Jr., Chairman
G. H. CLAMER
ALFRED C. HARRISON

NATHAN HAYWARD
WILLIAM C. WETHERILL

EXECUTIVE COMMITTEE

E. H. SANBORN, Chairman
CHARLES DAY
WALTON FORSTALL

ALFRED W. GIBBS
ALFRED C. HARRISON

COMMITTEE ON EXHIBITIONS

BENJAMIN FRANKLIN, Chairman.
FRANCIS T. CHAMBERS
THEOBALD F. CLARK

CHARLES DAY
CHARLES A. HEXAMER

FRANKLIN FUND AND BUILDING COMMITTEE

HENRY HOWSON, Chairman

WALTON CLARK, Treasurer

ALFRED C. HARRISON

COMMITTEE ON INSTRUCTION

LAWRENCE T. PAUL, Chairman
GEO. A. HOADLEY
HARRY F. KELLER

EDW. V. McCAFFREY
JAMES S. ROGERS

Officers of Instruction

Louis C. Robinson, Director
H. E. Barrett
John C. Bechtel
H. H. Blizzard
R. E. Brown
G. W. H. Fawkes
H. H. Fox
H. W. Howitz
Karl E. Klabe
Frederick Miller

James G. Morgan
W. Earl Neilson
B. A. Owen
William S. Owen
I. P. Pedrick
Clement Remington
A. J. Stretton
J. W. Thompson
B. B. Wood

THE FRANKLIN INSTITUTE

7

COMMITTEE ON PUBLICATIONS

GEORGE D. ROSENGARTEN, Chairman

GEORGE A. HOADLEY

G. H. CLAMER

E. H. SANBORN

W. C. L. EGLIN

Editorial Staff of the Journal

R. B. OWENS, Editor

Associate Editors

Brig. Gen. James Allen

Ralph Modjeski

Joseph S. Ames

L. A. Osborne

Wilder D. Bancroft

Albert Sauveur

John J. Carty

Maj. Gen. Geo. O. Squier

A. S. Cushman

C. P. Steinmetz

A. S. Eve

S. W. Stratton

W. J. Humphreys

Chief Con. D. W. Taylor, U.S.N.

Harry F. Keller

R. S. Woodward

A. E. Kennelly

A. F. Zahm

Gaetano Lanza

COMMITTEE ON SECTIONAL ARRANGEMENTS

HARRY F. KELLER, Chairman

ROBERT W. LESLEY

GELLERT ALLEMAN

C. C. TUTWILER

GEORGE R. HENDERSON

COMMITTEE ON STOCKS AND FINANCE

WALTON FORSTALL, Chairman

JAMES S. ROGERS

BENJAMIN FRANKLIN

E. H. SANBORN

ALFRED C. HARRISON

COMMITTEES OF THE INSTITUTE

COMMITTEE ON LIBRARY

H. J. M. CREIGHTON, Chairman
CHARLES E. BONINE
GEORGE S. CRAMPTON
CLARENCE A. HALL
GEORGE A. HOADLEY
HARRY F. KELLER

MARSHALL S. MORGAN
PAUL SPENCER
GEORGE F. STRADLING
W. C. WETHERILL
ALFRED RIGLING, *Librarian*

COMMITTEE ON MEETINGS

GELLERT ALLEMAN, Chairman
CHARLES BASKERVILLE
G. H. CLAMER
ALLERTON S. CUSHMAN
GEORGE R. HENDERSON

JOSEPH S. HEPBURN
HERBERT E. IVES
A. E. KENNELLY
M. M. PRICE
GEO. D. ROSENGARTEN

COMMITTEE ON MUSEUM

A. E. OUTERBRIDGE, Jr., Chairman
HUGO BILGRAM
ARTHUR L. CHURCH
CHARLES DAY
GEORGE A. HOADLEY

C. W. MASLAND
CHARLES PENROSE
H. H. QUIMBY
COLEMAN SELLERS, JR.

COMMITTEE ON SCIENCE AND THE ARTS

| | |
|-------------------------------|------------------------|
| CHARLES Wm. MASLAND, Chairman | HERBERT E. IVES |
| HENRY B. ALLEN | W. N. JENNINGS |
| JAMES BARNES | HARRY F. KELLER |
| GEORGE H. BENZON, JR. | GAETANO LANZA |
| HUGO BILGRAM | LIONEL F. LEVY |
| CARL P. BIRKINBINE | PAUL A. LEWIS |
| CHARLES E. BONINE | LEO LOEB |
| RICHARD P. BROWN | HIRAM S. LUKENS |
| HAROLD CALVERT | EDW. V. McCAFFREY |
| WILLIAM C. CARNELL | J. Y. McCONNELL |
| G. H. CLAMER | K. G. MACKENZIE |
| EDWARD L. CLARK | CHARLES PENROSE |
| THEOBALD F. CLARK | M. M. PRICE |
| THOMAS D. COPE | H. H. QUIMBY |
| GEORGE S. CRAMPTON | FRANK ROGERS |
| H. J. M. CREIGHTON | JAMES S. ROGERS |
| J. A. P. CRISFIELD | L. F. RONDINELLA |
| GEORGE S. CULLEN | J. M. RUSBY |
| P. T. DASHIELL | RICHARD C. SELLERS |
| W. C. L. EGLIN | JOHN P. B. SINKLER |
| OWEN B. EVANS | WILLIAM H. THORNE |
| BENJAMIN FRANKLIN | JOHN C. TRAUTWINE, 3RD |
| WALTER H. FULWEILER | C. C. TUTWILER |
| CLARENCE A. HALL | JAMES G. VAIL |
| NATHAN HAYWARD | FRANCIS R. WADLEIGH |
| GEORGE R. HENDERSON | J. M. WEISS |
| JOSEPH S. HEPBURN | WILLIAM C. WETHERILL |
| CARL HERING | ROBERT L. WOOD |
| GEORGE A. HOADLEY | |

Standing Sub-Committees

The Franklin Medal

| | |
|---------------------------|--------------------|
| HARRY F. KELLER, Chairman | G. H. CLAMER |
| JAMES BARNES | H. J. M. CREIGHTON |

Literature

| | |
|--------------------------|------------------|
| THOMAS D. COPE, Chairman | L. F. RONDINELLA |
| BENJAMIN FRANKLIN | J. M. RUSBY |
| HARRY F. KELLER | |

New Subjects and Preliminary Examination

| | |
|------------------------------|---------------------|
| H. J. M. CREIGHTON, Chairman | GEORGE R. HENDERSON |
| CHARLES E. BONINE | LIONEL F. LEVY |
| GEORGE S. CRAMPTON | CHARLES PENROSE |
| BENJAMIN FRANKLIN | M. M. PRICE |
| NATHAN HAYWARD | JAMES S. ROGERS |

COMMITTEES OF THE INSTITUTE

COMMITTEE ON LIBRARY

H. J. M. CREIGHTON, Chairman
 CHARLES E. BONINE
 GEORGE S. CRAMPTON
 CLARENCE A. HALL
 GEORGE A. HOADLEY
 HARRY F. KELLER

MARSHALL S. MORGAN
 PAUL SPENCER
 GEORGE F. STRADLING
 W. C. WETHERILL
 ALFRED RIGLING, *Librarian*

COMMITTEE ON MEETINGS

GELLERT ALLEMAN, Chairman
 CHARLES BASKERVILLE
 G. H. CLAMER
 ALLERTON S. CUSHMAN
 GEORGE R. HENDERSON

JOSEPH S. HEPBURN
 HERBERT E. IVES
 A. E. KENNELLY
 M. M. PRICE
 GEO. D. ROSENGARTEN

COMMITTEE ON MUSEUM

A. E. OUTERBRIDGE, JR., Chairman
 HUGO BILGRAM
 ARTHUR L. CHURCH
 CHARLES DAY
 GEORGE A. HOADLEY

C. W. MASLAND
 CHARLES PENROSE
 H. H. QUIMBY
 COLEMAN SELLERS, JR.

COMMITTEE ON SCIENCE AND THE ARTS

| | |
|-------------------------------|------------------------|
| CHARLES Wm. MASLAND, Chairman | HERBERT E. IVES |
| HENRY B. ALLEN | W. N. JENNINGS |
| JAMES BARNES | HARRY F. KELLER |
| GEORGE H. BENZON, JR. | GAETANO LANZA |
| HUGO BILGRAM | LIONEL F. LEVY |
| CARL P. BIRKINBINE | PAUL A. LEWIS |
| CHARLES E. BONINE | LEO LOEB |
| RICHARD P. BROWN | HIRAM S. LUKENS |
| HAROLD CALVERT | EDW. V. McCAFFREY |
| WILLIAM C. CARNELL | J. Y. McCONNELL |
| G. H. CLAMER | K. G. MACKENZIE |
| EDWARD L. CLARK | CHARLES PENROSE |
| THEOBALD F. CLARK | M. M. PRICE |
| THOMAS D. COPE | H. H. QUIMBY |
| GEORGE S. CRAMPTON | FRANK ROGERS |
| H. J. M. CREIGHTON | JAMES S. ROGERS |
| J. A. P. CRISFIELD | L. F. RONDINELLA |
| GEORGE S. CULLEN | J. M. RUSBY |
| P. T. DASHIELL | RICHARD C. SELLERS |
| W. C. L. EGLIN | JOHN P. B. SINKLER |
| OWEN B. EVANS | WILLIAM H. THORNE |
| BENJAMIN FRANKLIN | JOHN C. TRAUTWINE, 3RD |
| WALTER H. FULWEILER | C. C. TUTWILER |
| CLARENCE A. HALL | JAMES G. VAIL |
| NATHAN HAYWARD | FRANCIS R. WADLEIGH |
| GEORGE R. HENDERSON | J. M. WEISS |
| JOSEPH S. HEPBURN | WILLIAM C. WETHERILL |
| CARL HERING | ROBERT L. WOOD |
| GEORGE A. HOADLEY | |

Standing Sub-Committees

The Franklin Medal

| | |
|---------------------------|--------------------|
| HARRY F. KELLER, Chairman | G. H. CLAMER |
| JAMES BARNES | H. J. M. CREIGHTON |

Literature

| | |
|--------------------------|------------------|
| THOMAS D. COPE, Chairman | L. F. RONDINELLA |
| BENJAMIN FRANKLIN | J. M. RUSBY |
| HARRY F. KELLER | |

New Subjects and Preliminary Examination

| | |
|------------------------------|---------------------|
| H. J. M. CREIGHTON, Chairman | GEORGE R. HENDERSON |
| CHARLES E. BONINE | LIONEL F. LEVY |
| GEORGE S. CRAMPTON | CHARLES PENROSE |
| BENJAMIN FRANKLIN | M. M. PRICE |
| NATHAN HAYWARD | JAMES S. ROGERS |

PAST OFFICERS

1824-1921

PRESIDENTS

| | |
|--------------------------------|-------------------------------|
| BANES, CHARLES H., 1886 | ROGERS, ROBERT E., 1875-1878 |
| BIRKINBINE, JOHN, 1897-1906 | RONALDSON, JAMES, 1824-1841 |
| CLARK, WALTON, 1907- | SELLERS, COLEMAN, 1870-1874 |
| CRESSON, JOHN C., 1855-1863 | SELLERS, WILLIAM, 1864-1866 |
| MERRICK, J. VAUGHAN, 1867-1869 | TATHAM, WILLIAM P., 1879-1885 |
| MERRICK, SAMUEL V., 1842-1854 | WILSON, JOSEPH M., 1887-1896 |

VICE-PRESIDENTS

| | |
|--|--------------------------------------|
| AGNEW, JOHN, 1851, 1855-1863 | HOWSON, HENRY, 1904- |
| BALDWIN, MATTHIAS W., 1855-1863 | JONES, WASHINGTON, 1900-1910 |
| BECK, PAUL, JR., 1826-1827 | LEVY, LOUIS E., 1916-1919 |
| BULLOCK, CHARLES, 1879-1900 | LONGSTRETH, EDWARD, 1890-1894 |
| CAREY, MATTHEW, 1824-1828 | LUKENS, ISAIAH, 1824-1825, 1829-1846 |
| CARTWRIGHT, HENRY, 1880-1881 | MILLER, ABRAHAM, 1847-1854 |
| CHRISTIE, JAMES, 1911 | MITCHELL, J. E., 1876-1887 |
| CLOSE, CHARLES S., 1875-1879 | MOORE, BLOOMFIELD H., 1869-1876 |
| CRESSON, GEORGE V., 1898-1903 | MORRIS, HENRY G., 1870-1879 |
| DAY, CHARLES, 1920- | RAND, THEODORE D., 1897-1903 |
| DODGE, JAMES M., 1903-1915 | ROGERS, FAIRMAN, 1864-1866 |
| EREBY, GEORGE, 1867 | ROGERS, ROBERT E., 1868-1874 |
| FLETCHER, THOMAS, 1828-1850, 1852-1854 | SELLERS, COLEMAN, 1867-1869 |
| FRAZER, JOHN F., 1865-1866 | SELLERS, COLEMAN, JR., 1912- |
| GRAFF, FREDERICK, 1882-1890 | TATHAM, WILLIAM P., 1888-1897 |
| HEYL, HENRY R., 1895-1897 | TOWNE, JOHN H., 1864-1868 |

RECORDING SECRETARIES

| | |
|--------------------------------------|--------------------------------|
| BULKLEY, JAMES H., 1831-1832 | PEROT, WILLIAM S., 1833-1834 |
| GARRIGUES, ISAAC B., 1830, 1837-1863 | ROBERTS, ALGERNON S., 1829 |
| JONES, THOMAS P., 1827-1828 | STRICKLAND, WILLIAM, 1824-1826 |
| JONES, WASHINGTON, 1864 | TRAUTWINE, JOHN C., 1835-1836 |

CORRESPONDING SECRETARIES

| | |
|--------------------------------|--------------------------------|
| BACHE, ALEX. DALLAS, 1840-1844 | FRALEY, FREDERICK, 1855-1863 |
| BRIGGS, ROBERT, 1864 | FRAZER, JOHN F., 1845-1847 |
| BROWNE, PETER A., 1824-1827 | HAYS, ISAAC, 1828-1839 |
| CRESSON, JOHN C., 1854 | ROBERTS, SOLOMON W., 1848-1853 |

SECRETARIES

| | |
|--------------------------|------------------------------------|
| CHRISTIE, JAMES, 1909 | OWENS, ROBERT B., 1910- |
| KNIGHT, J. B., 1875-1879 | WAHL, WILLIAM H., 1871-1874, 1882- |
| MORTON, HENRY, 1865-1870 | 1908 |
| NORRIS, ISAAC, 1879-1881 | |

TREASURERS

| | |
|---|-------------------------------|
| BORGNER, CYRUS, 1908-1920 | MERRICK, SAMUEL V., 1828-1829 |
| FLETCHER, THOMAS, 1824-1825 | RICHARDSON, JOHN, 1826-1827 |
| FRALEY, FREDERICK, 1830-1847, 1865-1882 | SARTAIN, SAMUEL, 1883-1906 |
| FRANKLIN, BENJAMIN, 1920- | TREGO, CHARLES B., 1847 |
| FRAZER, JOHN F., 1848-1864 | WAHL, WILLIAM H., 1907 |

ACTUARIES

| | |
|--|----------------------------------|
| CHRISTIE, JAMES, Feb. 21-June 11, 1908 | JESTER, SIMEON VAN T., 1916-1918 |
| HAMILTON, WILLIAM, 1828-1871 | LARZELERE, JAMES S., 1908-1916 |
| HEYL, HERBERT L., 1885-1908 | ROBINSON, LOUIS C., 1918- |
| HOLMAN, DAVID S., 1872-1885 | WAHL, WILLIAM H., 1872 |

LIBRARIANS

| | |
|--------------------------------|------------------------|
| HILTEBRAND, EMANUEL, 1874-1887 | RIGLING, ALFRED, 1887- |
|--------------------------------|------------------------|

MANAGERS

| | |
|---|------------------------------------|
| ABBOT, WILLIAM, 1824-1826 | BAUGH, HARMAN, 1855 |
| ADAMSON, WILLIAM, 1864 | BEALE, JOSEPH, 1827 |
| ADDICKS, JOHN E., 1845-1850 | BEARDSLEY, ARTHUR, 1894-1902 |
| AGNEW, JOHN, 1831-1850, 1852-1854 | BECK, PAUL, JR., 1824-1825 |
| ALLEMAN, GELLERT, 1918- | BEMENT, CLARENCE S., 1871 |
| ALLEN, JAMES, 1845 | BEMENT, WILLIAM B., 1866-1870 |
| ALLISON, WILLIAM C., 1863 | BERGNER, THEODORE, 1870-1875 |
| ARCHER, ELLIS S., 1858-1859 | BETTS, WILLIAM C., 1844 |
| BACHE, ALEX. DALLAS, 1830-1839 | BIDDLE, CLEMENT C., 1824 |
| BALCH, EDWIN S., 1902-1912 | BILGRAM, HUGO, 1885-1890 |
| BALDWIN, MATTHIAS W., 1827-1854 | BIRKBECK, JOHN, 1869-1871 |
| BANES, CHARLES H., 1877-1885, 1887-1895 | BIRKINBINE, HENRY P. M., 1851-1856 |
| BARKER, GEORGE F., 1874-1875 | BIRKINBINE, JOHN, 1907-1915 |
| BARRAS, JOSEPH J., 1851-1860 | BOLTON, JAMES M., 1830 |
| BARTOL, BARNABAS H., 1863-1865 | BONINE, CHARLES E., 1921- |
| BARTOL, HENRY W., 1870-1878 | BORGNER, CYRUS, 1903-1907 |
| BAUGH, DANIEL, 1900-1902 | BOSWELL, WILLIAM L., 1896-1898 |
| | BOWER, HENRY, 1891-1896 |

MANAGERS—(Continued)

- BRIGGS, ROBERT, 1867-1873
 BROCK, ROBERT C. H., 1901-1906
 BROLASKY, HENRY C., 1897-1902
 BRYSON, JAMES H., 1857-1863
 BULKLEY, JAMES H., 1830, 1833-1841
 BULLOCK, CHARLES, 1868-1878
 BURNHAM, GEORGE, 1878
 BURTIS, AARON H., 1845
 CARR, WILLIAM H., 1837-1845
 CARTWRIGHT, HENRY, 1865-1879
 CHABOT, CYPRIEN, 1877-1889
 CHAMBERS, CYRUS, JR., 1876-1890
 CHAMBERS, FRANCIS T., 1913-
 CHASE, PLINY E., 1864-1886
 CHRISTIE, JAMES, 1897-1908
 CLAMER, G. H., 1917-
 CLARK, THEOBALD F., 1917-
 CLARK, WALTON, 1903-1906
 CLARKE, JAMES, 1824-1826
 CLOSE, CHARLES S., 1865-1874
 CLOUD, JOSEPH, 1824
 CODMAN, JOHN E., 1892-1894
 COLLINS, ISAAC, 1828
 CONARD, THOMAS P., 1894-1908
 CONARROE, GEORGE W., 1851-1863
 COOPER, JOHN H., 1870-1873
 COPPER, JOHN C., 1851
 CORNELIUS, ROBERT, 1855-1863
 CORNELIUS, ROBERT C., 1866-1868
 CRAMP, CHARLES H., 1864-1867,
 1875, 1895-1897
 CRESSON, GEORGE V., 1886-1897
 CRESSON, JOHN C., 1835-1853
 CRESSON, WILLIAM P., 1848-1849
 DARRACH, CHARLES G., 1894-1896
 DAY, CHARLES, 1908-1919
 DIVINE, WILLIAM, 1864
 DODGE, KERN, 1916-1920
 DODGE, JAMES M., 1896-1903
 DONALDSON, JOSEPH, 1825
 DOUGHERTY, JAMES, 1858-1861
 DRAPER, EDMUND, 1847-1850
 DREER, FERDINAND J., 1862
 DROWN, WILLIAM A., 1861-1863
 DU BOIS, WILLIAM L., 1880-1882
 DURFEE, WILLIAM F., 1872-1873
 EASTWICK, ANDREW M., 1836-1844
 EASTWICK, EDWARD P., 1859-1860
 EBERT, MORRIS, 1908-1911
 ECKERT, GEORGE M., 1852-1854
 EGLIN, W. C. L., 1908-
 EISENHUT, JOHN D., 1824-1825
 ELDRIDGE, G. MORGAN, 1885-1890
 ELLIS, JAMES P., 1848-1851
 EMERSON, G., 1828
 EREBY, GEORGE, 1854-1866
 EVANS, OWEN, 1844-1857
 FARR, GEORGE W., 1851
 FERGUSON, ALEXANDER, 1831-1841
 FLETCHER, THOMAS, 1826-1827
 FLING, WILLIAM B., 1842
 FORSTALL, WALTON, 1908-
 FOX, GEORGE, 1828-1830
 FRALEY, FREDERICK, 1829, 1848-1854
 FRANKLIN, BENJAMIN, 1917-
 FRAZER, JOHN F., 1844, 1865-1866
 FRAZER, PERSIFOR, 1880-1891, 1903-1909
 FRAZIER, GEORGE H., 1898
 FRENCH, HOWARD B., 1900
 FRY, WILLIAM, 1825
 GARDINER, JOHN, JR., 1864
 GARRIGUES, ISAAC B., 1825-1829, 1831-
 1836
 GARRISON, F. LYNWOOD, 1890-1895,
 1897-1903
 GAWTHROP, HENRY, 1896-1898
 GIBBS, ALFRED W., 1915-
 GIBSON, J. HOWARD, 1893-1894
 GIBSON, JOHN J., 1912-1915
 GILDER, JOHN, 1838-1841
 GILPIN, THOMAS, 1824
 GOBRECHT, CHRISTIAN, 1828-1830
 GOLDSMITH, E., 1908-1916
 GRAHAM, HOWARD S., 1920-1921

MANAGERS—(Continued)

| | |
|---|---|
| GRAFF, FREDERICK, 1852-1854, 1858-1865, 1880-1881 | JAYNE, HARRY W., 1891-1910 |
| GREBLE, EDWIN, 1841-1863 | JENNINGS, W. N., 1896 |
| GREENE, STEPHEN, 1898-1908 | JOHNSON, LAWRENCE, 1855-1859 |
| GRIES, JOHN M., 1858-1862 | JONES, THOMAS P., 1826 |
| GRIFFITH, R. EGGLESFIELD, 1870-1871 | JONES, WASHINGTON, 1859-1895, 1897-1900 |
| GRIFFITH, ROBERT E., 1827 | KATEZ, I., 1824 |
| GROVES, DANIEL, 1824-1827 | KEATING, WILLIAM H., 1824-1826, 1830-1840 |
| HAND, JAMES C., 1845-1846 | KELLER, HARRY F., 1914- |
| HANSELL, WILLIAM S., 1827 | KELLY, HENRY H., 1851 |
| HARDING, GEORGE, 1864-1865 | KING, ROBERT P., 1851 |
| HARKER, JOSHUA G., 1831-1836 | KIRK, CHARLES H., 1830 |
| HARPER, JAMES, 1824-1826 | KIRKPATRICK, GEORGE E., 1911-1914 |
| HARRIS, WILLIAM, 1860-1863 | KNEASS, WILLIAM, 1825 |
| HARRISON, ALFRED C., 1895- | KNIGHT, DANIEL R., 1845 |
| HARRISON, C. LELAND, 1899-1902 | KRUMBHAAR, ALEXANDER, 1898-1911 |
| HARRISON, JOHN, 1824-1829 | KUHN, C. HARTMAN, 1896-1905 |
| HARRISON, JOSEPH, JR., 1854, 1856-1859 | LAMBERT, WM. H., 1906 |
| HART, SAMUEL, 1865-1870 | LESLEY, ROBERT W., 1913- |
| HAVILAND, JOHN, 1824-1826 | LE VAN, W. BARNET, 1864-1876 |
| HAYS, ISAAC, 1840-1841 | LEVY, LOUIS E., 1903-1915 |
| HAYWARD, NATHAN, 1917- | LEWIS, ENOCH, 1868-1894 |
| HELLER, CHARLES S., 1879-1880 | LEWIS, HARVEY, 1824-1827 |
| HELME, WILLIAM, 1869-1888 | LEWIS, MORDECAI D., 1828-1836 |
| HENDERSON, GEORGE R., 1915- | LINDSAY, JOHN, 1843 |
| HERSE, GEORGE P., 1851 | LINDSAY, ROBERT, 1834-1836 |
| HEXAMER, CHARLES A., 1904- | LINNARD, JAMES M., 1836-1838 |
| HEYL, HENRY R., 1879-1895, 1898-1909 | LINVILLE, J. HAYES, 1868 |
| HOADLEY, GEORGE A., 1911- | LONGSTRETH, CHARLES, 1903-1907 |
| HORN, HENRY, 1824 | LONGSTRETH, EDWARD, 1868-1870, 1895-1897 |
| HORSTMANN, WILLIAM J., 1865-1868 | LOUD, THOMAS, 1829-1831 |
| HOUSTON, EDWIN J., 1874-1897 | LOVE, WILLIAM H., 1859 |
| HOWARD, GEORGE C., 1855-1858 | LUCAS, JOHN, 1888-1894 |
| HOWE, HERBERT M., 1898-1900 | LUKENS, ISAIAH, 1828 |
| HOWSON, CHARLES HENRY, 1903-1907 | LUKENS, JAWOOD, 1902-1908 |
| HOWSON, HENRY, 1898-1903 | LYMAN, BENJAMIN S., 1901-1902 |
| HUFTY, SAMUEL, 1834-1850 | MCALPINE, JAMES, 1825-1828 |
| HUMPHREYS, SAMUEL, 1826 | MCCAFFREY, E. V., 1910- |
| HUNTER, JAMES, 1864 | MCCAMBRIDGE, RICHARD, 1876 |
| HUTCHINSON, CHARLES H., 1888-1890 | MCCLURE, JOHN, 1853-1856 |
| HUTCHINSON, JAMES, 1841-1842 | MCCLURG, ALEXANDER, 1833-1839 |
| HUTCHINSON, JOSEPH, 1860-1863 | MCEUEN, THOMAS, 1829 |

MANAGERS—(Continued)

- MCKEAN, WILLIAM V., 1879-1883
 MARKS, WILLIAM D., 1881-1884
 MARSHALL, SAMUEL R., 1887-1893
 MASON, DAVID H., 1824
 MASON, JAMES S., 1861
 MEGARGEE, CHARLES, 1858
 MEIRS, RICHARD WALN, 1908-1917
 MERRICK, J. VAUGHAN, 1864-1866,
 1870-1884
 MERRICK, SAMUEL V., 1824-1827,
 1830-1841, 1855-1863
 MIFFLIN, LLOYD, 1825-1826
 MILES, FREDERICK B., 1874
 MILLER, ABRAHAM, 1824-1846, 1855-
 1858
 MITCHELL, J. E., 1874
 MITCHELL, WILLIAM A., 1864-1865
 MORRIS, ISAAC P., 1836-1843
 MOORE, BLOOMFIELD H., 1864-1868
 MOORE, JOSEPH W., 1860-1861
 MORGAN, MARSHALL S., 1914-
 MORRIS, ELWOOD, 1844-1847
 MORRIS, HENRY G., 1864-1869
 MORRIS, WILLIAM E., 1847-1851
 MUCKLE, M. RICHARDS, JR., 1894-1896
 NAYLOR, JACOB, 1863, 1865-1872
 NEAFIE, JACOB G., 1868
 NEWHALL, PAUL W., 1843-1844
 NORRIS, ISAAC, 1870-1878, 1883-1918.
 NYSTROM, JOHN W., 1873-1875
 OGDEN, JOHN M., 1833
 OGLE, WILLIAMS, 1845-1850
 O'NEILL, JOHN, 1827-1832
 ORR, HECTOR, 1871-1887
 OUTERBRIDGE, ALEX. E., JR., 1881-1886
 PALMER, B. FRANKLIN, 1862
 PARRISH, WILLIAM D., 1838, 1852-
 1854
 PARRY, CHARLES T., 1864
 PATTERSON, ROBERT, 1824
 PATTERSON, ROBERT M., 1825-1827
 PAUL, LAWRENCE T., 1895-
 PEMBERTON, HENRY, JR., 1891-1896
 PERRY, ROBERT S., 1912-1916
 PETTIT, HORACE, 1894-1910
 PURVES, ALEXANDER, 1875-1876
 RALSTON, ASHBEL G., 1825-1830
 RAMAGE, ADAM, 1824-1832
 RAND, THEODORE D., 1874-1897
 REED, WILLIAM B., 1832-1836
 REEVES, BENJAMIN, 1829-1837
 REEVES, SAMUEL J., 1864
 REEVES, STACY, 1889-1902
 RICE, JOHN, 1866-1867
 RICHARDS, MARK, 1831
 RICHARDSON, JOHN, 1825
 RIEHLE, HENRY J., 1826-1827
 ROBBINS, SAMUEL J., 1827-1833
 ROBERTS, ALGERNON S., 1828
 ROBERTS, PERCIVAL, 1864-1868
 ROBERTS, SOLOMON W., 1842-1847
 ROBINSON, ALEXANDER P., 1911-1916
 ROGERS, EVANS, 1854-1863
 ROGERS, HENRY D., 1838-1843
 ROGERS, JAMES S., 1909-
 ROGERS, ROBERT E., 1867
 RONALDSON, CHARLES E., 1885-1893,
 1908-1912
 ROSENGARTEN, GEORGE D., 1912-
 ROWLAND, JAMES, JR., 1829-1830
 ROWLAND, WILLIAM, 1828
 RUSH, WILLIAM, 1825
 RUST, JAMES I., 1824
 SADTLER, SAMUEL P., 1888-1897
 SANBORN, E. H., 1907-
 SARTAIN, JOHN, 1877-1879
 SARTAIN, SAMUEL, 1865-1882
 SAVERY, PELEG B., 1851-1852
 SAXTON, JOSEPH, 1842-1844
 SAY, BENJAMIN, 1832-1833
 SCATTERGOOD, THOMAS, 1829-1834
 SCHAUM, OTTO W., 1907
 SCHREINER, JOSEPH H., 1827-1832
 SCHUMANN, FRANCIS, 1899-1902

MANAGERS—(Continued)

| | |
|---|--|
| SEIPER, THOMAS, 1824 | VAUX, GEORGE, JR., 1898-1899 |
| SELLERS, COLEMAN, 1862-1866, 1875-1905 | WALTER, THOMAS U., 1829-1831, 1840-1851 |
| SELLERS, COLEMAN, JR., 1906-1911 | WARDER, WILLIAM S., 1825-1827 |
| SELLERS, WILLIAM, 1857-1861, 1867-1892 | WARNER, JOHN S., 1837-1843 |
| SHAIN, CHARLES J., 1884-1887 | WEAVER, JACOB, 1856-1857 |
| SHINN, EARLE, 1836-1837 | WEAVER, JOHN J., 1880-1891 |
| SLOAN, SAMUEL, 1864 | WEIGHTMAN, WILLIAM, 1862-1863 |
| SMITH, CHARLES E., 1852-1855 | WETHERILL, CHARLES, 1835 |
| SOUDER, JACOB, 1828 | WETHERILL, J. P., 1902 |
| SPANGLER, HENRY W., 1891-1893 | WETHERILL, JOHN P., 1824-1825 |
| STEVENSON, WILLIAM, JR., 1828 | WETHERILL, WILLIAM, 1832 |
| STEWART, THOMAS S., 1842-1850, 1852-1863 | WETHERILL, WILLIAM C., 1916- |
| STRICKLAND, WILLIAM, 1828 | WEYGANDT, THOMAS J., 1851-1863 |
| STRUTHERS, JOHN, 1827-1849 | WHARTON, WILLIAM, JR., 1871 |
| TABER, GEORGE, 1839-1842 | WHITAKER, GEORGE P., 1851-1852 |
| TATHAM, WILLIAM P., 1870-1878, 1886-1887 | WHITE, CHARLES H., 1828-1835 |
| THOMPSON, AMBROSE W., 1839-1843 | WHITE, SAMUEL S., 1864-1867 |
| THOMSON, ELIHU, 1878-1881 | WHITNEY, ASA, 1846-1850 |
| THORNE, WILLIAM H., 1881-1897 | WHITNEY, GEORGE, 1858-1860 |
| THORNLEY, JOHN, 1851 | WHITNEY, JAMES S., 1862-1863, 1865-1869 |
| TILGHMAN, BENJ. C., 1871-1875 | WHITNEY, JOHN R., 1861 |
| TOPPAN, CHARLES, 1831-1832 | WICKHAM, M. T., 1824 |
| TOWNE, JOHN H., 1840-1857, 1869 | WIEGAND, JOHN, 1831-1853 |
| TOWNSEND, EDWARD Y., 1866-1867 | WIEGAND, S. LLOYD, 1864, 1890-1893 |
| TRACY, ELIASHIB, 1851 | WILLIAMS, EDWARD H., 1871-1872 |
| TRAUTWINE, JOHN C., 1834, 1844, 1852-1857 | WILLIAMS, ISAAC S., 1846-1850, 1852-1863 |
| TRAUTWINE, JOHN C., JR., 1891-1895 | WILSON, JOSEPH M., 1869-1886 |
| TREGO, CHARLES B., 1837-1846 | WILSON, O. HOWARD, 1864-1869 |
| TREVOR, JOHN B., 1832 | WOLBORN, CORNELIUS A., 1844-1850 |
| TROTH, HENRY, 1837-1841 | WOLF, OTTO C., 1897-1913 |
| TRYSON, GEORGE W., 1831-1833 | WOOD, ALAN, 1845-1863 |
| TUTWILER, C. C., 1920- | WOOD, SAMUEL R., 1824-1825 |
| TYLER, RUFUS, 1826-1837 | WOOD, WALTER, 1903-1912 |
| VAUCLAIN, SAMUEL M., 1898, 1906 | WOOTEN, JOHN E., 1860-1862 |
| WALTER, JOSEPH S., JR., 1834-1837 | YARDLEY, WILLIAM, JR., 1829 |
| | YEAGER, JOSEPH, 1832 |
| | YOUNG, ANDREW, 1828-1830 |

PAST CHAIRMEN OF THE 1834-1921 COMMITTEE ON SCIENCE AND THE ARTS

| | |
|---|---|
| BACHE, ALEXANDER D., 1834-1836, 1839-1844 | KOENIG, G. A., 1888-1889 |
| BEARDSLEY, ARTHUR, 1892-1895 | LEVY, LOUIS E., 1901-1902 |
| BILGRAM, HUGO, 1906-1907 | LEWIS, WILFRED, 1912-1913 |
| BONINE, CHARLES E., 1916-1917 | MARBURG, EDGAR, 1899-1900 |
| CHRISTIE, JAMES, 1897-1898 | MARKS, W. D., 1881-1882, 1887-1888 |
| CLAMER, G. H., 1915-1916 | MCCONNELL, JACOB Y., 1909-1910 |
| CONARD, THOMAS P., 1902-1903 | ORR, HECTOR, 1880-1881 |
| CREIGHTON, H. JERMAIN, 1918-1919 | PATTERSON, R. M., 1836-1839 |
| CRESSON, J. C., 1844-1876 | PENROSE, CHARLES, 1920-1921 |
| CRISFIELD, J. A. P., 1913-1914 | ROGERS, JAMES S., 1908-1909 |
| ELDRIDGE, G. MORGAN, 1896-1897 | RONALDSON, CHARLES E., 1903-1904 |
| FRANKLIN, BENJAMIN, 1919-1920 | RONDINELLA, L. F., 1898-1899 |
| GOLDSMITH, EDWARD, 1905-1906 | SARTAIN, SAMUEL, 1895-1896 |
| GRIGGS, WILLIAM O., 1907-1908 | SELLERS, COLEMAN, 1875-1880 |
| HAUPT, LEWIS M., 1904-1905 | SPANGLER, H. W., 1890-1891 |
| HENDERSON, GEORGE R., 1914-1915 | SPENCER, THOMAS, 1910-1911 |
| HEYL, HENRY R., 1882-1887, 1893- 1894, 1900-1901 | WETHERILL, WILLIAM C., 1917-1918 |
| HODLEY, GEORGE A., 1911-1912 | WIEGAND, S. LLOYD, 1889-1890, 1891- 1892 |

THE INSTITUTE'S ACTIVITIES

THE FRANKLIN INSTITUTE was organized in the year 1824 to meet a demand in America for an Institution similar to that founded by Count Rumford in London in 1799. The founders intended it not only as an appropriate memorial to the name of Franklin, but as means of continuing for all time a work which throughout his long life he perhaps regarded as his best, namely, the discovery of physical and natural laws and their application to increase the well-being and comfort of mankind.

The Hall of the Institute is located on the east side of Seventh Street, between Market and Chestnut Streets, and was built from plans furnished by John Haviland, architect. The corner-stone was laid with appropriate Masonic and other ceremonies, on the eighth day of June, 1825, at noon. The funds for the purchase of the lot and the erection of the building were provided by the issue of a building loan, which was freely taken by members and friends of the enterprise, and has long since been repaid. The building was completed, and the Institute took possession of all except the second floor (which was occupied by the United States Courts until 1830) in 1826. Upon the first floor are located the lecture-room (capable of accommodating about 300), and laboratories and offices. The second floor is occupied by the library, to which special attention is paid elsewhere. The third floor is given up entirely to the use of the School of Mechanic Arts.

THE LIBRARY

The plan of the founders contemplated "the formation of a library of books relating to science and the useful arts, and the opening of a reading-room;" and, accordingly, in 1827, the first Committee on Library was appointed.

The books forming the nucleus of the library were stored in the residence of a member of the committee until early in the year 1829, when the first reading room was opened. During the next year a special committee of twenty issued an appeal for books and contributions of money in aid of the library.

The founding of the JOURNAL, in 1826, by opening the way to the establishment of exchange relations with other societies and with the leading magazines and periodicals devoted to science and the useful arts, proved an invaluable help in promoting its growth, and thus, early, gave to the library the distinctive character which it has since maintained. From the nucleus formed by this useful agency has grown a reference library of scientific literature, in some branches unique, and, in extent and completeness, second to none in the United States, embracing the publications of the principal scientific and technical societies of the world, and the leading periodicals devoted to science and the arts.

Several of the foreign governments have deposited with the library complete sets of their patent office publications. There are on the shelves for reference files of the specifications of the patent office of Great Britain since the year 1617, of France since 1791, of Switzerland since 1888, of the United States since 1790. Abstracts of the patents granted by Germany, Russia, Canada, Australia, Hungary and Austria can also be consulted.

The library is annually enriched, also, by the gift of numerous technical publications of a miscellaneous character from foreign governments, and from States and municipal authorities and corporations. These embrace publications relating to public works; official reports relating to geology, the mining and metallurgical industries, agriculture, public health, municipal engineering; reports of railway and other transportation companies, manufacturing corporations, etc.

For many years it has been the policy of this committee to increase the value of the collection as a library of reference, and to this end it has devoted systematic effort to the task of completing the files of its important serial publications. In this work, the committee, with the substantial assistance of several liberal contributions of money from generous friends of the Institute, has been notably successful.

At the present time the collection consists of 74,668 volumes and 16,597 pamphlets.

To inventors and manufacturers seeking for information respecting the state of the arts and manufactures, the extensive collection of patent literature which the library places at their disposal is indispensable, and the library is constantly resorted to by attorneys and their clients for the purpose of consulting these volumes; while, to the professional man and the student, the scientific and technical serials in which the library is so rich are no less indispensable as an aid in pursuing their investigations.

THE COMMITTEE ON SCIENCE AND THE ARTS

A branch of the Institute's work, which, perhaps, more obviously than any other, illustrates the spirit which animated the founders, and which their successors have worthily perpetuated and striven to improve and extend, is that which is now conducted by the Committee on Science and the Arts.

One of the things that was, apparently, uppermost in the thoughts of the founders, was the need—as urgent then as to-day—felt by inventors and discoverers, of some competent, trustworthy and impartial body, to whom they could safely appeal for advice, and on whose judgment they could confidently rely for an opinion, as to the usefulness of their inventions and discoveries.

One of the first acts of the Board of Managers was to appoint a Board of Examiners, whose duty it was to examine and make report upon all new and useful machines, inventions and discoveries submitted to them. Subsequently the name of the Board of Examiners was changed to the "Committee on Inventions."

This organization continued in existence until the year 1834, when, by act of the Institute, it was abolished, and in its place there was established the "Committee on Science and the Arts," with enlarged powers and a wider field of labor. As originally constituted, membership in this committee was open to all members of the Institute in good standing who chose to enroll their names, and who by thus voluntarily associating themselves with the committee, pledged themselves to perform the duties assigned to them.

Under this form of organization the committee continued for more than fifty years, and its usefulness during this long period is attested by its records, containing the results of the examination of a great number of inventions, and of its investigations of many subjects of importance entrusted to it by the Institute.

In the year 1886, the Institute adopted an amendment to its by-laws, by which this committee was reorganized on an elective basis, thus abolishing the plan of voluntary association which had heretofore been a distinguishing feature. By this amendment the Institute established a Committee on Science and the Arts, to be composed of forty-five members of the Institute, to be chosen at the annual election (fifteen each year), and "who shall pledge themselves by their acceptance of membership to perform such duties as may devolve upon them, and to sustain by their labors the scientific character of the Institute."

Some years later the membership of the committee was increased from forty-five to sixty and by a provision recently adopted the members are elected by the Board of Managers, twenty each year.

During the past twenty-five years the committee has investigated over 900 discoveries, processes, and inventions.

THE JOURNAL

The publication of a journal for the diffusion of knowledge on all subjects connected with science and the useful arts, was embraced in the plan of the founders, and was undertaken shortly after the organization had been effected. This publication has been continued without interruption to the present time, and has proved most useful, not only in directly promoting the aims and objects of the Institute, but also in extending the sphere of its influence beyond the limits of its local habitation.

The first step to secure a publication was taken by the Institute as early as 1825, when, by arrangement with C. S. Williams, publisher, a magazine bearing the title *The American Mechanics' Magazine*, and which had been founded by him in New York at the beginning of that year, was acquired by Dr. Thomas P. Jones, who had recently been elected professor of mechanics in The Franklin Institute. At the outset the responsibility of this venture appears to have been assumed by Dr. Jones, after he had received assurances of active co-operation and support from the members of the Institute, who were warmly interested in its success.

The prospectus of the new publication, which was issued August 1, 1825, announced the fact that "shortly will be published

THE
FRANKLIN JOURNAL
AND
MECHANICS' MAGAZINE,

Under the Patronage
of the

FRANKLIN INSTITUTE, OF THE STATE OF PENNSYLVANIA, FOR THE PROMOTION OF THE
MECHANIC ARTS. EDITED BY DR. THOMAS P. JONES, PROFESSOR OF
MECHANICS IN THE INSTITUTE."

The object of *The Franklin Journal*, as defined in the prospectus, was, "to diffuse information on every subject connected with useful arts."

In the prospectus of *The Franklin Journal* attention is called to the fact that it was intended to give a list of patented inventions, with remarks upon their utility and originality. This proposition was literally maintained and continued as a prominent feature of the JOURNAL to the close of 1859, save that the "Remarks," which were in many cases of the greatest value to those interested in the progress of the arts and manufactures, were discontinued on the death of Dr. Jones. His accession to the position of Superintendent of the Patent Office naturally caused him to devote special attention to the preservation of the record of patents in the pages of the JOURNAL. This circumstance has since proved of considerable value to all who have need to refer to the early patents of the United States, as will appear from the following explanation:

In the official Patent Office publications, issued by the Government prior to the year 1843, the publication of the claims was omitted; while, for a considerable period, the JOURNAL published an abstract of the specifications and the claims in full. The JOURNAL, consequently, is the only source at present available for reference to the specifications and claims of patents issued by the United States, from 1828 to 1842, inclusive. The JOURNAL can also be used, in place of the official publications, as a source of reference to the patents granted during the period 1826-1859 in which the patent lists were published therein.

The complete file of the JOURNAL embraces *The Franklin Journal*, 1826-1827, and the JOURNAL OF THE FRANKLIN INSTITUTE, 1828 to the present time; 190 volumes in all, with a General Index, 1826 to 1885, and three decennial volumes covering the years 1886 to 1915, inclusive.

In its present form, the JOURNAL is an octavo of over 150 pages. It is published monthly, the twelve impressions being divided into two volumes yearly—January to June and July to December, each separately paged, and supplied with title-page and index.

THE SCHOOL OF MECHANIC ARTS

The first Board of Managers of the Institute provided for the establishment of a standing Committee on Instruction, charged with the duty of directing its educational work.

This committee speedily perfected plans for systematic instruction by means of lectures and demonstrations. Professorships in chemistry, in natural philosophy and mechanics, and in architecture were established and filled by the election of capable instructors.

Provision was next made for the instruction of mechanics and apprentices and those engaged in the useful trades, and early in the fall of 1824 a school of mechanical and architectural drawing was established. This experiment seems to have been crowned with complete success; and the managers proceeded to establish another school, in which should be taught "all the useful branches of English literature and the ancient and modern languages." This project was realized in 1826. In 1827 over three hundred scholars were upon its roll. It was the model upon which the Central High School, shortly afterwards established by the city as part of the public school system, was patterned. With the organization of the public high school, that of the Institute was abandoned as unnecessary. The drawing school, however, was continued, and has maintained an uninterrupted existence to the present. Its leading feature—that of training pupils for actual work in shop and office—has always been rigorously preserved, and at the present time, as a school for mechanical draughtsmen, it is conceded, by those best qualified to judge, to be one of the most thorough and practical of any in the country.

Twenty-three years ago classes in mathematics were established; these later became a part of the school of machine design. Instruction in naval architecture was first given in October, 1899.

All departments of instruction were united in the year 1910 and are now known as the School of Mechanic Arts.

LECTURES

These have always occupied a prominent place in the scheme of the Institute's work, from the beginning to the present.

The first course was given in the old Academy Building, on Fourth Street, near Arch, owned by the University of Pennsylvania, the use of which for this purpose was granted by the trustees; and the work of the professors was ably supplemented by a corps of volunteer lecturers from the membership of the Institute. A little later, the Institute rented the lower floor of the old Carpenters' Hall for this purpose, and finally, on the completion and occupancy of the hall, the lectures were held in its own lecture room.

For many years the lectures were of the nature of regular courses on architecture, mechanics, physics, and chemistry, varied of course from year to year, but following generally the plan of graded or consecutive instruction, as in schools and colleges. This system, however, though for a long period admirably useful in meeting the needs of the public, was found in time to be gradually outgrowing its usefulness. Lecture courses on scientific themes, which for years had been practically pre-empted by The Franklin Institute, in time were made attractive features in the schools and colleges, and the popular science lecturer became a conspicuous figure on the public lecture platform. And so it came about, naturally, that the Committee on Instruction

found it advantageous gradually to modify its plans to adapt them to the changes of the times. For a number of years, accordingly, the character of the Institute lectures has departed widely from the old-time pattern. The object at present most conspicuously kept in view in the selection of the lectures is to give the members of the Institute the advantage of having presented to them the latest advances in the useful arts and the sciences bearing thereon; and, to this end, the committee's efforts each year are directed to the purpose of securing the services of men of eminence in their respective fields of labor, who are invited to select their own themes. Since its foundation The Franklin Institute has given free to the public thousands of lectures by distinguished scientists and technologists on scientific and technological subjects in addition to numerous popular and illustrated addresses on subjects of immediate interest to the public and germane to the topics of the day.

MEETINGS

General meetings of the Institute's entire membership are held once each month, except during the summer. At these meetings great inventions and discoveries, important engineering projects, and notable achievements in all fields of scientific progress are presented, exhibited or discussed. Many of the epoch-making inventions have been shown in their experimental stages at these meetings—as the phonograph, the electric light, the typewriter, liquid air apparatus, machine telegraphy, etc.

EXHIBITIONS

As a means of promoting the mechanic arts, the holding of exhibitions was highly favored by the founders, and in this field of activity the Institute, for many years, was conspicuously prominent.

The first exhibition of American manufactures was held in October, 1824, in Carpenters' Hall.

This, it should be remembered to the credit of the Institute, was the first of the kind to be undertaken in this country.

The exhibitions of the Institute were held yearly or biennially, down to the year 1858. Many of the earlier events took place in the old Masonic Hall, on Chestnut Street, above Seventh, and in a temporary annex thereto; and the more recent ones in the one-time famous Museum Building, at Ninth and Sansom Streets, the destruction of which by fire, in the year 1850, made it necessary for the managers, for several years, to adapt themselves to less desirable quarters, and finally to discontinue the exhibitions for a time for want of a centrally located building suitable for the purpose.

In the year 1874 occurred the fiftieth anniversary of The Franklin Institute, and a fortunate circumstance enabled the managers to signalize the event by holding an exhibition, which proved from every point of view an eminently successful one. The circumstance spoken of was the fact that the Pennsylvania Railroad Company placed at the service of the Institute, for exhibition purposes, the old building at Thirteenth and Market Streets, for many years occupied as a freight station. Over 268,000 visitors attended this exhibition.

Successful, however, as was the exhibition of 1874, it was eclipsed in brilliancy, and in value from the educational and technical standpoint, by that of 1884, which will ever be memorable in the annals of The Franklin Institute. This was the Electrical Exhibition, held in the autumn of that year, under the direction of the Institute, and which by Act of Congress, approved February 26, 1883, was made international in character. It was the first exhibition in America devoted exclusively to the electrical arts.

In 1885 the Novelties Exhibition was held in the building erected for the electrical exhibition.

No further exhibitions have been held since that time, though the Institute co-operated with the Commercial Museum of Philadelphia in the management of the National Export Exposition of 1899.

SOME INSTANCES OF THE INSTITUTE'S WORK

(CHRONOLOGICALLY STATED)

1824. It held the first Exhibition of American Manufactures in Carpenters' Hall on October 18, 19, 20. Silver medals were awarded for steel, domestic carpetings, straw and grass bonnets, etc.

Classes were established in Chemistry, Mechanics, Natural History, Architecture, Mathematics, and Drawing.

The first course of lectures commenced April 28 and was held in the Academy Building, Fourth Street near Arch.

1826. In January the first number of *The Franklin Journal* was issued under the editorial management of Dr. Thomas P. Jones, who two years later became Superintendent of the United States Patent Office.

It extended its educational efforts by establishing on April 6th a High School, in which Mathematics, Drawing, Geography, History, Latin, Greek, French, Spanish and German were taught. Three hundred and four pupils were in attendance in October.

Thirty-four thousand visitors attended the Institute's Third Industrial Exhibition during its four days' progress.

1827. Select Committee on Dry Docks made a lengthy illustrated report, giving costs, methods of operation, etc.

1829. Committee appointed to investigate the efficiency of moving water as a motive power (water wheel experiments).

1830. Committee appointed to inquire into causes of the explosion of steam boilers.

1831. Joint Committee of The Franklin Institute and American Philosophical Society first began systematic meteorological observations in aid of agricultural and other interests.

1832. Commission appointed to examine into the resources, including agricultural, of Pennsylvania, an action which led to a Geological Survey of the State.

Notable paper in JOURNAL OF THE FRANKLIN INSTITUTE by Professor Walter R. Johnson on "The Strength of Steam Boilers."

The Secretary of the Treasury of the United States requested a further extension of the Institute's inquiry into the causes of the explosion of steam boilers to include the prevention of steam boiler explosions.

Committee appointed to investigate the strength of materials. This committee devised apparatus of various forms for the testing of metals, steam boilers, building materials, etc.

The Institute was requested by the State Legislature to examine and report upon the then existing system of weights and measures.

1834. The Secretary of the Commonwealth of Pennsylvania presented the thanks of the State for the report on weights and measures received from the Institute.

1837. The general interest created by the Institute's work gave rise to a movement for the establishment of a school of arts. The project failed at that time, but resulted later in the founding of the Department of Science of the University of Pennsylvania.

1838. The report of the Committee on Uniformity of Weights and Measures was printed. (The present laws of the State are based on this report.)

1839. November JOURNAL contained full translation of Daguerre's original communication to the French Academy describing his discoveries in photography (the Daguerreotype).

1840. Professor A. D. Bache's report on education in Europe appeared in the JOURNAL. (This report was made for use in connection with the organization of Girard College.)

1843. The Pennsylvania Legislature appropriated \$4000 to be devoted to the purchase of instruments for the equipment of stations throughout the State for the systematic observation and collection of meteorological facts; the expenditure being left in the hands of the Institute.

This is the earliest instance on record of the appropriation, in any country, of public funds for the collection of facts relating to the weather.

1850. The School of Design for Women was founded by the Institute. Mrs. Sarah Peters, first Directress.

1863. Monthly reports of Meteorological Phenomena at Philadelphia were published in the JOURNAL. (These were continued to 1869.)

1864. The shape and proportion of screw threads used in machine construction were investigated by a special committee. The report of this committee was presented in 1865 and recommended for adoption by machine builders throughout the United States a uniform and simplified system of screw threads.

A few years later this was officially adopted by the Government, and under the designation of the "U. S." or "Franklin Institute Standard" is now in universal use.

1869. Resolutions passed by the meeting in August and addressed to Congress suggested an exhibition to commemorate the hundredth anniversary of the United States and resulted in the holding of the Centennial Exhibition of 1876.

Solar Eclipse Expedition to Iowa in August, Dr. Henry Morton, Director. The services of the observers were gratuitous, the instruments were borrowed and the transportation for the party and equipment was furnished by the railroads.

1872. Committee on the mode of determining the horsepower of steam boilers published its report.

1873. The Institute approved Professor Lesley's recommendation of a more thorough Geological Survey of Pennsylvania, and asked the Legislature

to give prompt and full effect to the same. (The beginning of the Second Geological Survey.)

Committee on Conflagrations and Deaths from Petroleum Used in Lamps. A full report. Resolutions were sent to the Governor and Legislature, requesting the appointment of a commission to investigate the subject, determine tests, and to make laws relating to the burning of oils in lamps.

1874. Fiftieth anniversary. Held great industrial exhibition at Thirteenth and Market Streets—the site of the Wanamaker store.

1875. City Councils appropriated money for the expenses of an expert commission to be nominated by The Franklin Institute and to act in conjunction with the Chief Engineer of the Water Department. To this commission was referred the subject of the present and future water supply of Philadelphia.

1876. The Pennsylvania Museum and School of Industrial Art housed and fostered by the Institute.

1882. Report of the Special Committee on the pollution of the Schuylkill River presented its report suggesting the construction of an intercepting sewer along the Eastern banks of the Schuylkill from Manayunk, with an outlet below the densely populated portions of the city.

1883. Special Committee on the prevention of fires in theatres presented an exhaustive report which contained thirty-eight recommendations intended to make places of amusement more safe.

1884. Without Federal or State aid the Institute held the first great International Electrical Exhibition.

The first International Conference of Electricians was held during the progress of the exhibition.

During and immediately after the exhibition the most complete and extended series of tests attempted to that time were made to determine the characteristics of all the more important types of electrical apparatus and appliances then commercially used.

The organization of The American Institute of Electrical Engineers this year resulted from the holding of the Electrical Exhibition and the International Conference of Electricians held under the auspices of the Institute.

1885. Novelties exhibition held in the buildings erected for use of the electrical exhibition.

1887. The Institute organized the Pennsylvania State Weather Service. Voluntary observers made regular reports on the weather conditions of the State. An appropriation was made by the State to cover cost of clerical services and printing. The service was in operation until 1891, when the State discontinued the appropriation.

1890. Joseph M. Wilson's voluminous report on schools, with particular reference to trade schools, appeared in the JOURNAL OF THE FRANKLIN INSTITUTE during the year. (This report served as a basis for the organization of the Drexel Institute.)

1894. Germantown Junction branch of the drawing school established.

1897. A communication from the Board of Health of the City of Philadelphia requested the Institute to appoint a committee to confer with the Board of Health with a view of taking action to abate or modify the smoke nuisance. A full report appeared in the JOURNAL.

1899. National Export Exposition held in conjunction with the Commercial Museum of Philadelphia.

1901. Resolutions passed to promote commerce by the improvement of waterways and approving the creation of the Department of Commerce.

1902. The metric system fully discussed at the monthly meetings. Resolutions passed petitioning the national government to enact such laws as will ensure its proper use.

1906. Resolutions passed urging the improvement of national waterways, particularly the Chesapeake and Delaware Canal.

1914. Conducted meeting in Philadelphia celebrating thirtieth anniversary of the International Electrical Exhibition.

1915. First awards of The Franklin Medal.

1917. Established and maintained a recruiting and examination station for applicants for admission to the aviation service of the United States Army. Established School of Navigation for the United States Shipping Board. Conducted Free Radio School for men of the selective draft.

CHARTER AND BY-LAWS

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS

An Act to amend and alter the Act incorporating The Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts.

WHEREAS, The Act approved March thirtieth, one thousand eight hundred and twenty-four, incorporating The Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, has been found insufficient and inconvenient for accomplishing the objects of said corporation, and the said corporation has applied for alteration and amendment thereof.

SECTION 1. Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania, in General Assembly met, and it is hereby enacted by the authority of the same, that the present members of said corporation, and all such persons as may hereafter become members thereof, shall be, and are hereby created, a body politic and corporate by the name of "THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS," and shall have perpetual succession, be able to sue and be sued, to plead and be impleaded, to have and use a common seal, and the same to break, alter and renew at pleasure, and shall be able to take, hold, purchase and enjoy such real and other estates of any nature or kind whatsoever as they may obtain by purchase, devise, bequest or gift, and the same at their pleasure to sell, lease, mortgage, pledge, encumber, or dispose of as they may deem proper or convenient for promoting the objects of the said corporation; and the said corporation shall have the like power over any real estate or other estates now owned or held by them; *provided*, that the clear yearly value of the real estate at any time held by them shall not exceed ten thousand dollars.

SEC. 2. That it shall be lawful for the said corporation to raise funds for the payment of its present indebtedness, and for all other purposes of the said corporation, to create and sell such number of shares of stock, at ten dollars each, as may be deemed proper to represent the estates of the said corporation, and the certificates of such stock shall be in such form, be transferable in such manner, subject to such payments, and entitle the holder thereof to such privileges, as the said corporation may, by its By-Laws in reference to such stock, grant and direct.

SEC. 3. The object of the said corporation shall be the promotion and encouragement of manufactures and the mechanical and useful arts, by the establishment of lectures on the sciences connected with them, by the formation of cabinets of models, minerals, machines, materials and products, by exhibitions and premiums, by a library and by all such measures as they may judge **expedient**.

SEC. 4. The members of the said corporation shall consist of manufacturers, mechanics, artisans, and persons friendly to the mechanic arts, and of such stockholders in said corporation as may, by the By-Laws, be entitled to the privileges of members; and every member shall pay such sum for an annual or life subscription as the By-Laws of said corporation may require; and honorary and corresponding members may be elected at such times, and in such a way, and with such privileges as said corporation may deem expedient.

SEC. 5. The said corporation shall be managed in such way, and by such number of officers, managers and other persons as the By-Laws may prescribe, and the powers and functions of such officers, managers or other persons, the rights and duties of members, the manner of their election, and the causes which may justify their expulsion or suspension, and all other concerns of the said corporation, shall be fixed and regulated by its By-Laws, which By-Laws shall be adopted by said corporation at the first monthly meeting after the acceptance of this amended Charter, and said By-Laws shall be altered and amended only in the manner provided in said By-Laws as then adopted.

SEC. 6. So much of the Act to which this is a supplement as is inconsistent herewith is repealed.

OFFICE OF THE SECRETARY OF THE COMMONWEALTH OF PENNSYLVANIA,

April 25th, 1864.

I certify that the foregoing bill passed both branches of the Legislature, and received the signature of the Governor on this day. As witness my hand the day and the year above written.

(Signed.)

ELI SLIFER, *Secretary of the Commonwealth.*

BY-LAWS OF THE INSTITUTE

ARTICLE I.—*Trustees.*

SECTION 1. All Real and Personal Estate of the Institute which may hereafter be acquired by voluntary subscription or devise, bequest, donation, or in any way other than through its own earnings or by investment of its own funds, saving where the donors shall expressly provide to the contrary, shall be taken as acquired upon the condition that the same shall be vested in a Board of Trustees, who shall be appointed in the manner hereinafter indicated. Unless the title to such property shall be directly vested in said Board of Trustees by the donors, the Institute, by deed attested by the President and Secretary, which they are hereby authorized to execute and deliver, shall forthwith convey the same to said Trustees, who shall hold it in trust for the purposes specifically designated by the donors; or, if there shall be no specific designation, for the benefit of the Institute in the way and manner hereinafter provided, so that the same shall not, in any event, be liable for the debts of the Institute.

SEC. 2. Said Board of Trustees shall be composed of seven (7) members, originally elected by the Board of Managers on its own nomination.

Vacancies, as they occur, shall be filled by election by the Board of Managers from nominations made by the remaining Trustees to a stated meeting of the Board of Managers at least one month prior to the election; the Board of Managers to have the right to reject any nominations not satisfactory to them.

The remaining members of the Board of Trustees, whenever at any time it shall be deemed necessary to do so, shall have power to assign and convey the property held by them, so as to vest the title thereto in themselves and their successors.

SEC. 3. Said Trustees shall have full power and authority, from time to time, to assign, sell and dispose of any property, real and personal, by them held, unless there shall be some direction by the donors to the contrary, and shall have power to convey the same without purchasers being obliged to see to the application of the purchase moneys, when authorized so to do by a vote of two-thirds ($\frac{2}{3}$) of the members present at any regular or special meeting of the Board of Managers; *provided*, that they shall not be obliged to sell or convey unless a majority of their own Board shall also approve.

SEC. 4. Said Trustees shall not be confined to legal investments, but shall have full power to invest in any real property, improvements and alterations, and in any securities, other than shares of stock, or unusual personal obligations, which to them may seem advisable.

SEC. 5. Said Trustees shall have power to appoint agents to act for them, and for the acts of such agents they shall not be personally responsible where they have exercised ordinary prudence in selecting them.

SEC. 6. Said Trustees shall have power to carry into effect any special trusts upon which any property may be held by them. They shall pay out all necessary and proper costs, charges and expenses, and from time to time shall pay over the net income to the Board of Managers, to be applied by them to the uses of the Institute in accordance with the terms of the trusts from which the income is derived.

The principal and interest of all trust funds shall not be liable for debts of the Institute but shall be devoted to its continuance and preservation.

SEC. 7. At the annual meeting of the Board of Managers in each year, said Board of Trustees shall present report of their proceedings and a detailed statement of their receipts and expenditures for the year. An approval of such account shall be final and conclusive, and shall bar any right to demand any other or further accounting.

SEC. 8. The Board of Trustees, at a meeting of the members of the Institute, called after three (3) months' special notice, at which the holders of nine-tenths ($\frac{9}{10}$) of the whole outstanding shares of stock shall vote affirmatively, may convey all property, real and personal, in them vested, to the Institute, free and clear of all trusts: *provided*, that there be no specific trusts violated by such conveyance, and that all the members of said Board, as the same shall then be constituted, shall approve of such conveyance.

ARTICLE II.—*Stock.*

SECTION 1. The Real and Personal Estates of the Institute as held upon the First day of January, One Thousand Eight Hundred and Eighty-one, shall be valued at One Hundred Thousand Dollars, and shall be represented by Ten Thousand Shares of Stock of the par value of Ten Dollars each. Said shares shall be divided into two classes, viz.:—

First Class.—Shares not registered for use: on which no annual payment shall be charged or collected, and the holders thereof shall not have the privileges of members of the Institute, but may, if of legal age, vote at any annual election for officers, managers and auditors, upon the payment of One Dollar upon each share of stock on which they may desire to vote; *provided, however,* such shares have been held by the same person at least three months before such election.

Shares of the First Class may be converted into shares of the Second Class at the pleasure of the owners, provided the transfer be approved by the Board of Managers; but, when once so converted, they shall always continue in the Second Class.

Second Class.—Shares registered for use: on which Twelve Dollars per annum shall be due and payable from resident members in advance on the first day of October in each year, except as hereinafter provided.

Non-resident holders of Second Class stock shall pay an annual fee of Five Dollars.

SEC. 2. The holders of Second Class stock shall be entitled to the use of the library, lectures and reading-room; and, if of legal age, to all other privileges of membership in the Institute, so long as they make the annual payment in advance; and shall, on the payment of One Dollar therefor, be entitled to a Certificate of Membership.

SEC. 3. If the annual dues for successive years remain unpaid at the expiration of two and a half years on any share of stock of the Second Class, such share shall then become forfeited to the Institute; but such forfeiture may be remitted by a unanimous vote of the Board of Managers.

SEC. 4. Stock of the Second Class may be held in trust for persons not of legal age, and shall be liable to the payment of only one-half the annual fees due upon stock of Second Class held by persons of legal age; *provided,* that when such minors arrive at legal age, new certificates, subject to the full annual contribution, shall issue on payment of the customary fee.

SEC. 5. Certificates for the First Class stock may be issued for any number of shares in a single certificate; but every certificate for the Second Class shall be for one share only.

SEC. 6. No share of stock in the Second Class shall be transferred until all arrearages and fines are paid, and all books and tickets returned, and the transfer approved by the Board of Managers.

SEC. 7. All certificates of stock shall be signed by the President and Secretary; shall be issued by the Actuary, and shall be transferable only on the books of the Institute by the owner, or his legal representative, on the

surrender of the old certificate, and of a fee of twenty-five cents for each certificate.

SEC. 8. All subscriptions to stock shall be approved by the Board of Managers before the certificate can be issued.

SEC. 9. The shares of stock obtained by the Institute by legacies, donations, or forfeiture shall at once be cancelled.

ARTICLE III.—*Members.*

SECTION 1. The members of the Institute shall consist of manufacturers, mechanics, artisans, and persons friendly to the mechanic arts, and they may be either annual contributors, associate members, life members, permanent members, holders of Second Class stock, honorary or corresponding members.

SEC. 2. The privileges of membership, other than associate membership, in the Institute shall extend only to persons of legal age who are not in arrears and who shall have signed the Charter and By-Laws.

SEC. 3. Annual contributors shall pay yearly dues of Fifteen Dollars; shall be entitled to all of the privileges of the Institute, and shall be eligible to any office or to membership upon any committee.

SEC. 4. Non-resident annual contributors shall pay an entrance fee of Five Dollars and annual dues of Five Dollars.

SEC. 5. Associate members shall be over seventeen and under twenty-five years of age. They shall have the right to attend all meetings of the Institute, use the library, receive the JOURNAL and serve upon committees, but they shall not have the right to vote or to hold office. They shall pay annual dues of Five Dollars. The term of an associate member shall be limited by the age of twenty-five years, after which he shall become an annual contributor with the dues and privileges of that class and he shall be duly notified of the transfer.

SEC. 6. Annual contributors, whether resident, non-resident or associate members, shall be elected by the Board of Managers.

SEC. 7. Honorary and Corresponding Members shall be nominated by the Board of Managers, and shall require for their election four-fifths of the votes of the members present, at any meeting of the Institute at which their nomination may be acted upon. They shall pay no dues.

SEC. 8. Life members, whose membership shall not be transferable, may be elected by the Board of Managers upon the payment of Two Hundred Dollars in any one year.

Non-resident Life members may be elected in the same way upon payment of Seventy-five Dollars in any one year.

SEC. 9. A permanent membership, which may be transferred by will or otherwise, subject to the approval of the Board of Managers, may be granted by the Board of Managers to any one who shall contribute to the Institute for that purpose the sum of One Thousand Dollars in any one year.

SEC. 10. Non-resident members shall be those who reside permanently at a distance not less than twenty-five miles from Philadelphia. Transfers of membership from the resident to non-resident class may be granted by the Board of Managers at its discretion in cases of temporary absence of a member from the city for a period of not less than one year.

SEC. 11. Members shall be entitled to a Certificate of Membership on payment of One Dollar.

SEC. 12. Resignations of membership shall be made to the Board of Managers in writing, but shall not be accepted until all dues, fines, and arrears of dues and current dues at the annual rate up to the date of resignation, shall have been paid, and books and tickets returned.

ARTICLE IV.—*Payments of Dues.*

SECTION 1. The annual payment of fees for membership shall be due and payable on the first of October in each year, in advance; but all members elected after the 31st of March in each year shall pay, in advance, for the current year, one-half of the annual dues.

SEC. 2. Any member whose dues are more than three months in arrears shall be notified by the Actuary. Should such dues not be paid when they become six months in arrears, the privileges of membership shall by that fact be suspended. When nine months in arrears such member shall be again notified, and if such dues become one year in arrears, the said member shall by that fact forfeit all connection with the Institute. The Board of Managers, however, may, for cause by it deemed sufficient, extend the time for payment and for the application of these penalties.

The Board of Managers may, for sufficient cause, temporarily excuse from payment of annual dues any member who from ill health, advanced age or other good reason assigned, is unable to pay such dues; and the Board may remit the whole or part of the dues in arrears or accept in lieu thereof service or material contributed to the Institute.

SEC. 3. Every person admitted to membership in the Institute shall be considered as liable for the payment of dues until he shall have resigned, been dropped or have been relieved therefrom by the Board of Managers.

SEC. 4. The annual dues from contributing members may be applied to the current expenses of the Institute, but all moneys received from life and permanent membership shall be vested in the Board of Trustees, the income therefrom only to be applied to the maintenance fund.

ARTICLE V.—*Officers.*

The officers shall be a President, three Vice-Presidents, a Secretary, a Treasurer, and twenty-five Managers. A majority of the Managers shall be persons directly interested in industrial pursuits.

ARTICLE VI.—*Election of Officers.*

SECTION 1. An election for officers shall be held on the third Wednesday in January in each year. At this election the President and the Treasurer shall be elected to serve one year, and one Vice-President, and eight Managers, shall be elected to serve for three years: *provided*, that the officers now elected or who may hereafter be elected, shall continue to serve until their successors be elected.

One Manager, to be known as the Alumni Manager, shall be elected in January of every third year, beginning in the year 1910, by the Alumni Association of the Institute, to serve for three years. A vacancy in this position shall be filled by election in the same manner for the unexpired term.

The Secretary shall be elected by the Board of Managers at their first stated meeting after the annual election each year.

SEC. 2. All elections for officers of the Institute shall be by letter ballot, and no vote may be cast by proxy, nor received from a member in arrears.

SEC. 3. Nominations for the annual election for officers shall be presented in writing at the stated meeting in the month of December. Each nomination paper must be signed by at least two members in good standing, who shall certify that the candidate will serve if elected. After the nominations are closed, the President shall appoint three members, who are neither officers nor nominees, to act as tellers of the election. The list of nominees shall promptly be posted at the Institute and incorporated (with directions for voting) in a ballot to be sent to each member by the Secretary at least one week before the date of the election. Each ballot shall be accompanied by a return envelope addressed "To the Tellers of Election," and provided with a space for the signature of the member voting.

SEC. 4. On the date of the annual election, and at an hour previously designated by their chairman, the tellers shall meet at the Institute and shall count all legal votes that have been received by mail or placed in the ballot box before 8 o'clock P.M.; and when the count is completed they shall report to the annual meeting of the Institute the total number of ballots cast, together with the number of votes received by each candidate. Thereupon the presiding officer shall announce the names of the candidates who received the plurality of votes for each office, and shall declare them elected officers of the Institute for the ensuing terms.

ARTICLE VII.—*President.*

It shall be the duty of the President, or, in his absence, of one of the Vice-Presidents, in order of seniority of election, or, in their absence, of a President to be chosen *pro tempore*, to preside at all meetings of the Institute and of the Board of Managers.

ARTICLE VIII.—*Secretary.*

SECTION 1. The Secretary of the Institute shall be a person of scientific attainments. He shall receive such salary as may be fixed by the Board of Managers.

SEC. 2. He shall have general charge and supervision, subject to the Board of Managers, of all the work of the Institute, and of its library, museum, laboratories, and property in general.

SEC. 3. He shall keep the minutes of all meetings of the Institute; and shall perform all the duties usually pertaining to the office of secretary.

SEC. 4. He shall be *ex officio* a member of the Board of Managers and of the standing committees of the Institute.

SEC. 5. As *ex officio* Secretary of the Committee on Science and the Arts he shall attend all meetings of that Committee and keep the minutes thereof. He shall also attend meetings of sub-committees at which his attendance has been requested, and when desired shall aid sub-committees in making searches and in the examination of authorities, documents, apparatus, etc.

Two weeks before each stated meeting of the Committee he shall report to its Chairman the status of all investigations pending before the sub-committees.

He shall also perform any other duty that may tend to advance the work of the Committee.

With the approval of the Board of Managers he may appoint an assistant to perform some, or all of his duties as Secretary of this Committee.

ARTICLE IX.—*Treasurer.*

It shall be the duty of the Treasurer to receive from the Board of Trustees all funds, which they may pay over to the Board of Managers in accordance with Section 6 of Article I. He shall also receive all moneys collected for the Institute by the Actuary. He shall deposit all moneys received, in the name of the corporation, in such institution as the Board of Managers may direct. He shall make no payments without written vouchers from the Board of Managers. He shall keep accurate accounts of the income and disbursements of the Institute, exhibit an accurate statement of his receipts and payments at each stated meeting of the Board of Managers, and of the condition of the finances of the Institute whenever called on by them, and shall make an annual statement thereof at the annual meeting of the Institute. He shall give bonds to an amount fixed by the Board of Managers for the faithful performance of his trust. In case of a vacancy in the office of treasurer, it shall be the duty of the Board of Managers to appoint a person to perform the duties of the position *pro tempore*.

ARTICLE X.—*Board of Managers.*

SECTION 1. The Board of Managers shall consist of 25 members elected as provided in Article VI; all officers of the Institute, *ex officio*, except the Trustees; and the Chairman of the Committee on Science and the Arts' *ex officio*.

The Board of Managers shall have entire charge and control of the current receipts and expenditures of the Institute, and of all its business affairs not specially reserved to the Board of Trustees, and shall have authority to do all acts not inconsistent with the rights and duties of the Trustees which may in their judgment advance the interests of the Institute.

They shall have authority, by exchange, sale or otherwise, to add to or subtract from the collections of books, furniture and apparatus, in such manner, however, that the aggregate value of the same to the Institute, at any time, may not be impaired.

They shall have authority to elect members of the Institute, except Honorary and Corresponding Members, who shall be elected by the Institute.

Sec. 2. They shall keep regular minutes of their proceedings, which shall be open at all times to inspection by members of the Institute.

Sec. 3. They shall present at the annual meeting of the Institute a report of their proceedings and of the conduct of the affairs of the Institute.

Sec. 4. They shall hold stated meetings once in each month. They shall elect their own officers, except the chairman, who shall be the President of the Institute, or in his absence, as provided for in Article VII, and shall be at liberty to make by-laws for their own regulation not inconsistent with the Charter, or with the By-Laws of the Institute. Seven of their members shall constitute a quorum.

Sec. 5. All vacancies in the Board of Managers shall be filled by an election at the next stated meeting of the Institute.

ARTICLE XI.—Audits.

The accounts of the Treasurer and Board of Trustees shall be audited at least once a year by certified public accountants, who shall report to the Board of Managers.

ARTICLE XII.—Committees of the Institute.

Section 1. There shall be the following Standing Committees, each to consist of ten members, to be appointed by the President at the first meeting after the annual election, who may be aided in his choice by nominations made at the annual meeting. All members notified of their appointment to any committee, if they do not decline before the next stated meeting, shall be considered members thereof:—

1. On the Library.
2. On the Museum.
3. On Meetings.

Sec. 2. There shall be a Committee on Science and the Arts, consisting of sixty members of the Institute, who shall pledge themselves by their acceptance of membership to perform such duties as may devolve upon them and to sustain by their labors the scientific character of the Institute.

They shall be elected by the Board of Managers at its stated meeting on the fourth Wednesday of January, twenty members being elected each year to serve for three years.

The Secretary shall report to the Board of Managers at said meeting the number of vacancies on the Committee from any cause, and the names of those whose terms expire that year, together with the record of their attendance at meetings of the Committee, and a brief summary of their participation in the work of the Committee and its sub-committees. Vacancies occurring during any year may be filled by the Committee itself by election of members to serve until the following January.

Within one month after the Annual Election, the Committee shall hold a meeting at which it shall elect a Chairman for the current year.

It shall be the duty of the Committee to investigate and report upon any

subject referred to it by a vote of the Institute, or any Section thereof, and at its discretion to investigate other subjects on application.

Applications for the examination of any subject shall be made to the Committee, either by recommendation of the Institute, or any Section thereof, or by requests from inventors or others, under the regulations of the Committee.

It shall also be the duty of the Committee to make or recommend the award of medals and other forms of recognition established by, or in charge of, the Institute.

Sub-committees to examine any subject shall be appointed by the Chairman of the General Committee from its membership, but they may include a minority of persons who are not members of the General Committee or of the Institute, but whose expert services are desired in the examination.

Reports of sub-committees shall be made to the General Committee in writing.

Final action on a report conferring or recommending an award shall not be taken by the General Committee except at the second or two successive stated meetings at which it has been read and been open for discussion and amendment.

A quorum for final action upon a report conferring or recommending an award shall consist of not less than fifteen members, and when such report is adopted it shall be accepted as the decision of the Institute.

Reports when issued after final adoption shall set forth that they are the action of The Franklin Institute by its Committee on Science and the Arts. They shall be signed by the President and the Secretary of the Institute and by the Chairman of the Committee; and the seal of the Institute shall be affixed thereto. The Committee may provide that such reports shall also be signed by the members of the respective sub-committees who made the investigations and prepared the reports.

The Chairman of the Committee shall submit to the stated meetings of the Board of Managers in October, December, February, April, and June of each year, a report of the number of investigations pending before the Committee, the number disposed of since the last report, with the action taken or award made in each case, and the number and nature of new investigations undertaken since the last report, and such other information as to the work of the Committee as the Board of Managers may require.

He shall also report to the stated meetings of the Institute such recent action of the Committee as he may deem of interest.

At the request of the Committee on Publications, and to make an adopted report more suitable for use in the JOURNAL of the Institute, the sub-committee that prepared the report shall have authority to amplify or abridge it without in any way changing its meaning or recommendation for award; but the fact of such modification must be stated as a note at the beginning of its publication in the JOURNAL.

SEC. 3. Each committee named in the first and second sections shall choose a chairman at its first meeting after its appointment.

Record of their proceedings shall be kept by the Secretary. They shall report to the Institute, and when required to the Board of Managers.

They shall be governed by such rules, not inconsistent with these By-Laws, as may be adopted by them respectively.

The Committees on the Library, on Meetings, and on Science and the Arts, shall meet at least once in each month, except in July and August.

SEC. 4. No bills for expenses incurred by committees shall be paid unless approved by the Committees which incurred them.

ARTICLE XIII.—*Meetings.*

SECTION 1. The Institute shall hold stated meetings on the third Wednesday of each month, except in June, July, August, and September. That on the third Wednesday in January of each year shall be the annual meeting.

SEC. 2. Special meetings shall be called by order of the President, upon request of the Board of Managers, or the written application of twelve members of the Institute. Fifteen members shall constitute a quorum.

ARTICLE XIV.—*Order of Business.*

SECTION 1. The stated meetings of the Institute shall be held at the hour of 8 o'clock P.M.

SEC. 2. The order shall be as follows:

1. Reading of the Minutes.
2. Reports from the Board of Managers.
3. Reports from the Standing Committees, etc.
 - (1) On the Library.
 - (2) On the Museum.
 - (3) On Meetings.
 - (4) On Science and the Arts.
4. Reports from Special Committees.
5. The paper announced for the evening.
6. The Secretary's report.
7. Deferred business.
8. Consideration of new business.

SEC. 3. At the annual meeting, the tellers' report may be received and read by the Secretary immediately after the conclusion of any number of the order of business.

SEC. 4. The order of business may be altered for any meeting by a vote of two thirds of the members present thereat.

ARTICLE XV.—*Rules.*

The Institute, at its meetings, shall be governed by Roberts' Rules of Order.

ARTICLE XVI.—*Organization and Government of Sections.*

SECTION 1. For the promotion and encouragement of manufactures and the mechanic arts, as well as of the sciences connected with them, members of the Institute may form sections and hold meetings in such rooms as may be provided for them by the Board of Managers. These sections shall be

constituted as hereinafter provided, and shall have precedence in the order of their formation.

SEC. 2. Any number of members, not less than twelve, may constitute a section.

SEC. 3. Members desiring to form a section shall make written application to that effect to the Committee on Sectional Arrangements, which committee shall report such applications to the Board of Managers.

If the application shall be approved by the Board of Managers, the section shall be established and the names of the petitioners shall be recorded on the minutes as the founders of that section, and shall be reported by the Board of Managers to the Institute at its next meeting. Whenever the petitioners shall have organized, they shall report such organization, with the names of their officers, to the Committee on Sectional Arrangements. But if they shall fail to organize such section within six months after the date of said approval, or if an established section shall fail to make a report of its proceedings to the committee during any period of twelve months, it shall be the duty of the Committee on Sectional Arrangements to inform the Board of Managers, which may thereupon declare that such section is extinct.

SEC. 4. All members of the Institute shall have the privilege of enrolling themselves, without payment of additional fees, as members of any of the sections which are now, or which may hereafter be, established in conformity with these By-Laws, and such enrollments shall be reported from month to month to the secretaries of the sections designated; but no person shall be entitled to any of the privileges of any of the sections who has not complied with the condition of Article III of these By-Laws.

SEC. 5. Each section shall submit to the Committee on Sectional Arrangements prior to the stated meeting of the Board of Managers in December of each year, an estimate of moneys it will require for the ensuing year, and such estimate the Committee on Sectional Arrangements shall transmit, with its recommendation, to the Board at its stated meeting in December.

SEC. 6. Each section shall elect its own officers and make its own by-laws, not inconsistent with the Charter and By-Laws of the Institute. The Institute shall not be responsible for bills contracted by any section in conformity with the conditions prescribed in Section 4 of Article XII of the By-Laws relating to committees, nor in any event for a sum greater in any one year than the amount appropriated by the Board of Managers for the service of the section for that year.

SEC. 7. All requisitions for supplies shall be made by order upon the Actuary of the Institute.

SEC. 8. The books, papers, apparatus, specimens, models, and all other collections of each section, shall be the property of the Institute, held for the use of that section. Donations of objects or books to or for any section, shall be received and reported to the Committee on Sectional Arrangements, and by this committee to the Board of Managers, as donations to the Institute for the use of that section.

SEC. 9. Each section shall determine, subject to the approval of the Board of Managers, the times of its stated meetings.

SEC. 10. Papers read and lectures delivered before any section and approved by the same, shall be referred to the Committee on Publications of the Institute, and if accepted by them, shall be published in the JOURNAL of the Institute.

SEC. 11. Societies now existing, or which may hereafter be founded, for the consideration of any subjects clearly within the scope of The Franklin Institute, and which societies may desire to unite with The Franklin Institute as sections, shall furnish a list of such of their members as have declared their willingness to become members of the Institute, to the Committee on Sectional Arrangements, which committee shall transmit the same, with its recommendation, to the Board of Managers.

SEC. 12. On all points not herein provided for, each section shall be governed by the Charter, By-Laws and usages of the Institute.

ARTICLE XVII.—*Amendments.*

Proposals for amendments to these By-Laws shall be presented in writing, signed by two members in good standing, at any stated meeting of the Institute. By a majority vote of the members present at this meeting they may be considered, amended, referred, postponed, rejected, or ordered to be voted upon at the date of the next stated meeting, until which time they shall be posted at the Institute. The final vote upon amendments shall be by ballot, and if two-thirds of the votes cast are in favor of any proposed amendment, it shall be declared adopted; except that amendments to Article II, relating to capital stock, must (subsequently) be ratified by a majority of the stock represented at a meeting specially called for this purpose.

BY-LAWS OF THE BOARD OF MANAGERS

(*As Amended June 8, 1910.*)

SECTION 1. *Officers.*—The President of the Institute, or, in his absence, the Vice-President, in order of seniority of election, or in the absence of both, a member elected *pro tempore*, shall preside at all meetings of the Board. Records of its proceedings shall be kept by the Actuary.

SEC. 2. *Meetings.*—The Board shall hold a meeting for the purpose of organizing, electing a Secretary, and a Committee on Science and the Arts; and appointing an Actuary, Standing Committees, etc., on the fourth Wednesday in January, and regular meetings on the second Wednesday of each month, at 3.30 o'clock P.M.

SEC. 3. Special meetings may be called by the President at his discretion, and shall be called on written request of five members of the Board. In case of his absence or refusal to act, such special meeting shall be called by the Actuary.

SEC. 4. *Actuary.*—An Actuary shall be appointed by the Board at their first meeting after the annual election. He shall keep a correct record of

their proceedings; keep a roll of the members, and note their attendance thereon; give notice of all meetings of the Board, and of Committees, delivered at least two days prior to the day of meeting; act as Secretary of the following Standing Committees of the Board: on Election and Resignation of Members; on Stocks and Finance; on Exhibitions; on Endowment. He shall notify all committees of the Board of their appointment. He shall collect and receive all moneys due to the Institute, and hand them over to the Treasurer; shall act as agent of the JOURNAL of the Institute, and shall transact such other business of the Institute as the Board shall direct. In all matters he shall be subject to the direction and control of the Board, and he shall receive such yearly compensation as they may determine.

SEC. 5. *Secretary.*—The Secretary of the Institute shall be *ex officio* a member of and act as secretary of the following Standing Committees of the Board: on Instruction; on Publications; on Sectional Arrangements; Executive.

SEC. 6. *Resignations.*—All resignations by members of the Board, after acceptance thereof, shall be reported to the Institute at its next stated meeting.

Members who have not attended six regular meetings prior to the stated meeting of the Institute in December, shall be reported thereat as having resigned, unless it be unanimously voted by the Board, at its stated meeting in December, that such member has been absent for sufficient reason.

SEC. 7. *Standing Committees.*—The following Standing Committees, consisting of five members each, shall be appointed by the President and approved by the Board:

1. On Instruction. 2. On Election and Resignation of Members. 3. On Stocks and Finance. 4. On Publications. 5. On Exhibitions. 6. On Sectional Arrangements. 7. On Endowment. 8. Executive.

It shall be the duty of the Executive Committee to make to the Board such recommendation as it may deem advisable, but in the absence of specific delegation of authority, it shall have no power to act on behalf of the Board.

It shall be the duty of all the committees to keep regular minutes of their proceedings, and report monthly to the Board, and to report through the Committee on Stocks and Finance to the stated meeting of the Board in September, an estimate of moneys they require for the service of the ensuing year.

SEC. 8. *Professorships.*—The Board may, at its discretion, establish such Professorships as may seem advisable, and on such subjects as it may designate, to serve until the next succeeding first meeting after the annual meeting.

SEC. 9. *Order of Business.*—The order at the stated meetings shall be as follows:

1. Calling the roll.
2. Reading the minutes and acting thereon.
3. Report from Treasurer, and action on bills.

SEC. 9. Each section shall determine, subject to the approval of the Board of Managers, the times of its stated meetings.

SEC. 10. Papers read and lectures delivered before any section and approved by the same, shall be referred to the Committee on Publications of the Institute, and if accepted by them, shall be published in the JOURNAL of the Institute.

SEC. 11. Societies now existing, or which may hereafter be founded, for the consideration of any subjects clearly within the scope of The Franklin Institute, and which societies may desire to unite with The Franklin Institute as sections, shall furnish a list of such of their members as have declared their willingness to become members of the Institute, to the Committee on Sectional Arrangements, which committee shall transmit the same, with its recommendation, to the Board of Managers.

SEC. 12. On all points not herein provided for, each section shall be governed by the Charter, By-Laws and usages of the Institute.

ARTICLE XVII.—*Amendments.*

Proposals for amendments to these By-Laws shall be presented in writing, signed by two members in good standing, at any stated meeting of the Institute. By a majority vote of the members present at this meeting they may be considered, amended, referred, postponed, rejected, or ordered to be voted upon at the date of the next stated meeting, until which time they shall be posted at the Institute. The final vote upon amendments shall be by ballot, and if two-thirds of the votes cast are in favor of any proposed amendment, it shall be declared adopted; except that amendments to Article II, relating to capital stock, must (subsequently) be ratified by a majority of the stock represented at a meeting specially called for this purpose.

BY-LAWS OF THE BOARD OF MANAGERS

(As Amended June 8, 1910.)

SECTION 1. *Officers.*—The President of the Institute, or, in his absence, the Vice-President, in order of seniority of election, or in the absence of both, a member elected *pro tempore*, shall preside at all meetings of the Board. Records of its proceedings shall be kept by the Actuary.

SEC. 2. *Meetings.*—The Board shall hold a meeting for the purpose of organizing, electing a Secretary, and a Committee on Science and the Arts; and appointing an Actuary, Standing Committees, etc., on the fourth Wednesday in January, and regular meetings on the second Wednesday of each month, at 3.30 o'clock P.M.

SEC. 3. Special meetings may be called by the President at his discretion, and shall be called on written request of five members of the Board. In case of his absence or refusal to act, such special meeting shall be called by the Actuary.

SEC. 4. *Actuary.*—An Actuary shall be appointed by the Board at their first meeting after the annual election. He shall keep a correct record of

their proceedings; keep a roll of the members, and note their attendance thereon; give notice of all meetings of the Board, and of Committees, delivered at least two days prior to the day of meeting; act as Secretary of the following Standing Committees of the Board: on Election and Resignation of Members; on Stocks and Finance; on Exhibitions; on Endowment. He shall notify all committees of the Board of their appointment. He shall collect and receive all moneys due to the Institute, and hand them over to the Treasurer; shall act as agent of the JOURNAL of the Institute, and shall transact such other business of the Institute as the Board shall direct. In all matters he shall be subject to the direction and control of the Board, and he shall receive such yearly compensation as they may determine.

SEC. 5. *Secretary*.—The Secretary of the Institute shall be *ex officio* a member of and act as secretary of the following Standing Committees of the Board: on Instruction; on Publications; on Sectional Arrangements; Executive.

SEC. 6. *Resignations*.—All resignations by members of the Board, after acceptance thereof, shall be reported to the Institute at its next stated meeting.

Members who have not attended six regular meetings prior to the stated meeting of the Institute in December, shall be reported thereat as having resigned, unless it be unanimously voted by the Board, at its stated meeting in December, that such member has been absent for sufficient reason.

SEC. 7. *Standing Committees*.—The following Standing Committees, consisting of five members each, shall be appointed by the President and approved by the Board:

1. On Instruction. 2. On Election and Resignation of Members. 3. On Stocks and Finance. 4. On Publications. 5. On Exhibitions. 6. On Sectional Arrangements. 7. On Endowment. 8. Executive.

It shall be the duty of the Executive Committee to make to the Board such recommendation as it may deem advisable, but in the absence of specific delegation of authority, it shall have no power to act on behalf of the Board.

It shall be the duty of all the committees to keep regular minutes of their proceedings, and report monthly to the Board, and to report through the Committee on Stocks and Finance to the stated meeting of the Board in September, an estimate of moneys they require for the service of the ensuing year.

SEC. 8. *Professorships*.—The Board may, at its discretion, establish such Professorships as may seem advisable, and on such subjects as it may designate, to serve until the next succeeding first meeting after the annual meeting.

SEC. 9. *Order of Business*.—The order at the stated meetings shall be as follows:

1. Calling the roll.
2. Reading the minutes and acting thereon.
3. Report from Treasurer, and action on bills.

4. Report from Standing Committees, and action thereon
 - (a) On Instruction.
 - (b) On Election and Resignation of Members.
 - (c) On Stocks and Finance.
 - (d) On Publications.
 - (e) On Exhibitions.
 - (f) On Sectional Arrangements.
 - (g) On Endowment.
 - (h) Executive.
5. Reports from Special Committees and action thereon.
6. Deferred Business.
7. New Business.

SEC. 10. *Amendments.*—These By-Laws may be altered at any stated meeting of the Board, provided the alteration be approved by two-thirds of the members present.

AWARDS BY THE INSTITUTE

The following awards are made by The Franklin Institute:

- The Franklin Medal.**
- The Elliott Cresson Medal.**
- The Howard N. Potts Medal.**
- The Edward Longstreth Medal.**
- The Certificate of Merit.**
- The Boyden Premium.**

The making or recommending of these awards is, by resolution of the Institute, entrusted to its Committee on Science and the Arts, a Committee consisting of sixty members of the Institute. This Committee recommends to the Institute the award of the Franklin Medal to distinguished scientists or technologists; and investigates, upon application, and reports on any worthy invention, discovery of process, recommending the award, according to merit, of the Elliott Cresson Medal, the Howard N. Potts Medal, the Edward Longstreth Medal, or the Certificate of Merit.

The Franklin Medal (Gold Medal and Diploma).—This medal is awarded annually from the Franklin Medal Fund, founded January 1, 1914, by Samuel Insull, Esq., to those workers in physical science or technology, without regard to country, whose efforts, in the opinion of the Institute, acting through its Committee on Science and the Arts, have done most to advance a knowledge of physical science or its applications.

The Elliott Cresson Medal (Gold Medal and Diploma).—This medal is awarded for discovery or original research, adding to the sum of human knowledge, irrespective of commercial value; leading and practical utilizations of discovery; and invention, methods or products embodying substantial elements of leadership in their respective classes, or unusual skill or perfection in workmanship.

The Howard N. Potts Medal (Gold Medal and Diploma).—This medal is awarded for distinguished work in science or the arts; important development of previous basic discoveries; inventions or products of superior excellence or utilizing important principles; and for papers of especial merit that have been presented to the Institute and published in its JOURNAL.

The Edward Longstreth Medal (Silver Medal and Diploma).—This medal, with a money premium when the accumulated interest of the fund permits, is awarded for meritorious work in science or the arts. In the

event of an accumulation of the fund for medals beyond the one hundred dollars, it is competent for the Committee on Science and the Arts to offer from such surplus a money premium for some work on any mechanical or scientific subject that is considered of some importance.

The Certificate of Merit.—A Certificate of Merit is awarded to an adjudged worthy thereof for their inventions, discoveries or productions.

The Boyden Premium (Premium of \$1000).—To any resident of America who shall determine by experiment whether all rays of light and other physical rays are or are not transmitted with the same velocity.

HISTORY OF THE MEDALS.

The Franklin Medal.—Samuel Insull, Esq., of Chicago, Illinois, writing under date of December 23, 1913, to the Board of Managers, stating that he had been informed it would be a source of gratification to them if the Institute had available, in addition to such medals already in its gifts, a medal known as The Franklin Medal, and to be awarded from time to time in recognition of the total contributions of individuals to science or to the applications of physical science to industry, rather than in recognition of a single invention or discovery, however important. He agreed to contribute for the founding of this medal under the following general conditions:

1. That an amount not exceeding one thousand dollars should be furnished by him for procuring appropriate design and dies for the medal and diploma.
2. That the medal should possess distinct artistic merit, and have on one side a medallion of Benjamin Franklin done from the Thomas Sully portrait in the possession of the Institute.
3. That the medal should be of gold and have an intrinsic value of about seventy-five dollars.
4. That the sum of five thousand dollars should be provided by him to be held in trust in perpetuity to be a foundation for this medal, and to be known as The Franklin Medal Fund (Founded January 1, 1914, by Samuel Insull, Esq.).
5. That the interest of this fund should be used from time to time in awarding The Franklin Medal to those workers in physical science or technology, without regard to country, whose efforts have, in the judgment of the Institute, done much to advance a knowledge of physical science or its application.
6. That any excess of income from this fund, beyond such average annual sum as might be deemed necessary by the Institute for the number of medals it is considered best to award, might be used for premiums to accompany the medals.

Mr. Insull said he understood that the Institute would be glad to award on the average two Franklin Medals a year. Though this would leave a surplus he inserted the sixth condition to prevent an undesirable accumulation of the fund.

At the Stated Meeting of the Board of Managers, February 11, 1914, the above offer was accepted, and its acceptance was confirmed to Mr. Insull in the following resolutions:

"Resolved, That the Board of Managers of The Franklin Institute of the State of Pennsylvania accept the offer of Mr. Samuel Insull to establish The Franklin Medal, under the conditions named in his letter of December 23, 1913.

"Resolved further, that it is the sense of the Board of Managers of The Franklin Institute that Mr. Insull, in founding this Medal, has rendered a notable service in stimulating workers in Physical Science and Technology and has extended materially the useful activities of the Institute.

"Resolved further, that the thanks of the Board of Managers of the Institute be, and are hereby, extended to Mr. Insull for his generous and greatly appreciated action.

"Resolved further, that an engrossed copy of these resolutions be forwarded to Mr. Insull."

On March 24, 1914, Mr. Insull forwarded his check for six thousand dollars, and the following deed was duly executed and delivered:

KNOW ALL MEN BY THESE PRESENTS, That THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS, hereinafter named The Franklin Institute, for and in consideration of the sum of Six Thousand (\$6,000) Dollars to it in hand paid by Samuel Insull, Esq., the receipt whereof is hereby acknowledged, does hereby certify and declare that it holds and will use said sum of money for the following uses, intents and purposes, and upon the following perpetual trusts, that is to say:

1. To expend One Thousand (\$1,000) Dollars, or so much thereof as may be necessary, for the purpose of paying for the design of a medal, and the necessary dies and diploma plates for the purposes hereinafter set forth.

2. To invest and keep invested the balance of said sum, and from the income derived from such investments from time to time to strike off and award medals from said design to workers in physical science or technology, without regard to country, whose efforts, in the opinion of the Board of Managers of said The Franklin Institute, have done most to advance our knowledge of physical science or its application. Should the income derived from this fund be more than necessary for the purposes aforesaid, the said The Franklin Institute may, in its discretion, award so much of the surplus, as its Board of Managers deems wise, as premiums to accompany said medals.

3. The fund thus set apart shall be known as "The Franklin Medal Fund" (Founded January 1, 1914, by Samuel Insull, Esq.).

4. The medals to be awarded as aforesaid shall be of gold, shall have distinct artistic merit, shall be of the intrinsic value of about seventy-five (\$75) dollars, and shall have on one side thereof a medallion of Benjamin Franklin taken from his portrait by Thomas Sully, now in the possession of the said The Franklin Institute.

IN WITNESS WHEREOF, The said The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts has hereunto set its common or corporate seal, attested by the signatures of its President and Secretary, this 28th day of March, A.D. 1914.

WALTON CLARK,
President.

R. B. OWENS,
Secretary.

[SEAL]

The Elliott Cresson Medal.—Under date of February 18, 1848, Elliott Cresson, Esq., of Philadelphia, Pennsylvania, conveyed to the Trustees for The Franklin Institute one thousand dollars of the six per cent. convertible loan of the President, Managers and Company of the Schuylkill Navigation Company—to hold the said sum and the interest to accrue thereon, for the following uses and purposes:

1. The trustees to keep the principal invested as it now (1848) is until it is reimbursed by the said Company, and immediately after such reimbursement to reinvest the said principal of one thousand dollars in such securities, bearing interest, as may by law be designated for the investment of trust funds. And from time to time, as the said principal sum may be reimbursed, to reinvest the same in like manner.

2. To cause suitable dies to be prepared for striking the gold medal out of the first sufficient moneys received for interest on the said sum of one thousand dollars, the dies to bear the following devices and inscriptions: The obverse,—a medallion likeness of the said Elliott Cresson with inscription around the margin, "Elliott Cresson Medal, A.D. 1848." Reverse,—around the margin, "Awarded by The Franklin Institute of Pennsylvania." The centre to be filled by engraving the name of the party to whom awarded and the year in which the award is made.

3. After the said dies have been prepared, and paid for out of the money received for interest, the said Trustees to cause to be struck, from time to time, such number of gold medals as the interest received will pay for, and to deliver the same to the Treasurer of The Franklin Institute, to be by him transmitted to such persons or parties as the said Franklin Institute may have awarded the same; the said awards, however, to be in all instances made either for some discovery in the arts and

sciences, or for the invention or improvement of some useful machine, or for some new process or combination of materials in manufactures, or for ingenuity, skill or perfection in workmanship.

The Howard N. Potts Medal.—Howard N. Potts, Esq., of Philadelphia, Pennsylvania, died July 24, 1906, leaving a will in which he provided for the establishment of this medal as follows:

"I give and bequeath to The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts and its successors, the sum of one thousand dollars, without deduction for taxes or charges; in trust to invest the same and apply the income thereof or such part or portion of it as may be adequate for the purpose, from time to time, to the purchase of a gold medal, to be awarded in the name of the said Franklin Institute for distinguished work in science or the mechanic arts."

The Edward Longstreth Medal.—In the month of May, 1890, Edward Longstreth, Esq., of Philadelphia, Pennsylvania, retired member of The Baldwin Locomotive Works, deposited with The Franklin Institute in trust, a registered bond of the Baltimore Traction Company for the sum of one thousand dollars, for the founding and perpetuation of the Edward Longstreth Medal of Merit; the interest accruing from said principal sum to be used in procuring and awarding said medals for the encouragement of invention, and in recognition of meritorious work in science and the industrial arts; the said awards to be made by The Franklin Institute through its Committee on Science and the Arts, under such rules as said Committee may adopt.

This donor further presented to The Franklin Institute twelve silver medals and the die therefor designed and executed under the direction of a committee of the Institute with his approval.

On May 14, 1890, the Board of Managers of The Franklin Institute, by resolution, accepted on behalf of the Institute the gifts of the donor, and on September 17, 1890, the Institute, by resolution following, confirmed the acceptance:

"*Resolved*, That the Institute hereby confirms the action of the Board of Managers in accepting the gift of foundation of the Edward Longstreth Medal of Merit, and in expressing its grateful acknowledgments for the gift.

"*Resolved*, That the grant of the Edward Longstreth Medal, in accordance with the wishes of the donor, be entrusted to the Committee on Science and the Arts, subject to such conditions as the said Committee, with the approval of the Institute, may propose."

The obverse of the medal bears the effigy of the donor, and is inscribed around the margin, "The Edward Longstreth Medal of Merit, Founded

1890." On the reverse is inscribed around the margin, "Awarded by The Franklin Institute," and in the centre is engraved the name of the recipient with the date and object of award.

On March 19, 1913, Charles Longstreth, son of the above-named Edward Longstreth, deposited with The Franklin Institute the further sum of one thousand dollars to be added to the original fund to be kept with it in trust in perpetuity, the interest to be used as is the interest of the original fund.

The Certificate of Merit.—At the stated meeting of the Institute, held on June 21, 1882, the following resolution was adopted:

"Resolved, That the Committee on Science and the Arts of The Franklin Institute is hereby authorized to award, and issue to persons by said Committee adjudged worthy, a Certificate of Merit for their inventions, discoveries or productions, which certificate shall read as follows:

'The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, awards to _____ this Certificate of Merit. This award is made pursuant to the recommendation of the Committee on Science and the Arts.

Report No. _____ Approved, _____ 19 _____

_____ —President.

[SEAL.]

_____ —Secretary.

Chairman of the Committee on Science and the Arts.'"

The Boyden Premium.—On March 23, 1859, Uriah A. Boyden, Esq., of Boston, Massachusetts, deposited with The Franklin Institute the sum of one thousand dollars to be awarded as a premium to any resident of North America who shall determine by experiment whether all rays of light, and other physical rays, are or are not transmitted with the same velocity.

The problem has been more specifically defined by the Board of Managers, as follows:

"Whether or not all rays in the spectrum known at the time the offer was made, namely, March 23, 1859, and comprised between the lowest frequency known thermal rays in the infra-red, and the highest frequency known rays in the ultra-violet, which in the opinion of the Committee lie between the approximate frequencies of 2×10^{14} double vibrations per second in the infra-red and 8×10^{14} in the ultra-violet, travel through free space with the same velocity."

An award, made during the year 1907, covered the solution of the problem so far as the transmission of the visible and ultra-violet rays is concerned. It has been directed by the Board of Managers that the balance of the fund be retained, to be awarded to such person as shall demonstrate whether or not the infra-red rays are or are not transmitted with the same velocity as the other rays.

REGULATIONS OF THE COMMITTEE ON SCIENCE AND THE ARTS

ARTICLE I.—*Investigations.*

SECTION 1. The Committee shall investigate, by sub-committee or otherwise, any subject referred to it by the Institute or by any of its sections; and upon a majority vote of the members present at any stated meeting, it may investigate any subject presented on motion of a member or by application as herein provided.

SEC. 2. Secret processes or compounds will not be considered by the Committee; nor will the treatment of materials by any substance be considered, unless the composition used and the method of treatment are fully disclosed.

SEC. 3. An applicant for investigation of a subject will be furnished by the Secretary with a copy of the regulations governing investigations.

SEC. 4. An application for investigation shall be made in writing on a blank, substantially like "Form A" below, which may be obtained from the Secretary. This application shall be addressed to the Secretary, who will upon receipt refer it to the Sub-Committee on New Subjects and Preliminary Examination; this sub-committee shall recommend to the Committee its acceptance or rejection, upon which the Secretary shall notify the applicant accordingly.

SEC. 5. It shall not be competent for any member of the Committee on Science and the Arts to be an applicant for any of the awards in the gift, or under the recommendation, of the said Committee, unless the subject for award be referred to the Committee by a vote of the Institute.

ARTICLE II.—*Meetings of the Committee.*

SECTION 1. The Committee shall hold stated meetings at 8 o'clock P.M. on the first Wednesday of each month, excepting July and August.

SEC. 2. Special meetings may be called by the Chairman, and shall be called by him upon the written request of five members of the Committee.

SEC. 3. At all meetings of the Committee nine members shall constitute a quorum for transacting general business, but for final action upon a report conferring or recommending an award or for amending the rules of the Committee, a quorum shall consist of not less than fifteen members.

SEC. 4. At its stated meeting the Committee shall proceed in the following

Order of Business:

1. Calling the roll.
2. Reading of the minutes of preceding meeting.
3. Reading of correspondence.

4. Approval of bills.
5. Report of Sub-Committee on New Subjects and Preliminary Examination.
6. Reports of standing and special sub-committees.
7. Consideration of reports for final action.
8. Reports of sub-committees on investigation, first reading.
9. Deferred business.
10. New business.
11. Adjournment.

SEC. 5. Members shall not be entitled to the floor more than twice on any question without the consent of the Committee.

SEC. 6. There shall be no debate on points of order except on an appeal from the decision of the Chairman, or on a question referred by him to the Committee. In such cases no member shall have the floor more than once without the consent of the Committee.

ARTICLE III.—*Chairman.*

SECTION 1. Nominations for a Chairman to serve for one year shall be made at the stated meeting of the Committee in February, and the election shall be by ballot at the same meeting, when the person receiving the highest number of votes shall be declared elected. He shall immediately assume office and shall perform his duties until his successor is installed. He shall not be eligible for election in two successive terms.

SEC. 2. The Chairman shall appoint the members of all sub-committees unless otherwise ordered, and may serve *ex officio* on all sub-committees except those charged with investigations.

SEC. 3. The election of a member as Chairman shall be held to vacate his membership of any and all sub-committees on investigation on which he may be serving, except if he has the report of such Committee prepared or in preparation, in which case he shall complete his work, but when such report is presented for consideration, he shall call on another member to preside while the subject is under discussion.

SEC. 4. The Chairman shall submit to the stated meetings of the Board of Managers in October, December, February, April, and June of each year, a report of the number of investigations pending before the Committee, the number disposed of since the last report, with the action taken or award made in each case, and the number and nature of new investigations undertaken since the last report, and such other information as to the work of the Committee as the Board of Managers may require. He shall also report to the stated meetings of the Institute such recent action of the Committee as he may deem of interest.

ARTICLE IV.—*Standing Sub-Committees.*

SECTION 1. There shall be appointed each February by the Chairman a sub-committee of not less than five members of the Committee, to be styled the "Sub-Committee on New Subjects and Preliminary Examination." The

duties of this sub-committee shall be to keep a general observation of progress made in science and the arts and to report to the Committee subjects adjudged worthy of investigation; to co-operate with the Secretary in keeping the work of the Committee properly before the public, and to recommend at each regular meeting the acceptance or otherwise of all applications for investigation. This sub-committee shall meet at least once prior to each regular meeting of the Committee.

SEC. 2. There shall be appointed each December by the Chairman from the membership with the consent and approval of the Committee, a sub-committee styled the "Sub-Committee on Literature." It shall be the duty of this sub-committee to examine carefully all papers that have been presented to the Institute and published in its JOURNAL during the current year, and to report to the Committee not later than the following April meeting which of these papers deserve the award of, viz.:

1. *The Howard N. Potts Medal;*
2. *The Certificate of Merit.*

The Institute, through the Committee, may award said medals to the authors of papers so recommended, except that it shall not so award more than one Potts Medal in any one year.

The Sub-Committee on Literature shall also consider any publication or treatise devoted to science or the mechanic arts, submitted by the Committee, and if in its judgment said work appears to be of unusual merit it may recommend that its author be awarded the Potts Medal, provided that such medal shall not be so awarded more than once in any one year.

Advertisement of these awards shall not be required.

SEC. 3. There shall be appointed annually by the Chairman from the membership a sub-committee styled the "Sub-Committee on Awarding the Franklin Medal," the duty of which shall be to make recommendations of the award of this medal under the provisions of the deed of gift.

ARTICLE V.—*Sub-Committees on Investigation of Applications.*

SECTION 1. Upon the acceptance of an application for investigation, a sub-committee shall be appointed by the Chairman to conduct the investigation.

SEC. 2. Sub-committees shall be appointed from the membership of the Committee, but they may include a minority of other persons whose expert services are desired in the examination.

SEC. 3. When the personnel of a sub-committee on investigation is finally determined, a notice shall be sent to each member thereof giving the names of the members of the sub-committee and setting forth the regulations governing investigations.

SEC. 4. No person shall be a member of a sub-committee on investigation who is interested in the issue.

SEC. 5. After a subject has been assigned to a sub-committee for investigation it shall not be withdrawn without the consent of the Committee.

SEC. 6. When the Secretary has obtained the necessary information from the applicant, he shall notify the sub-committee, who shall then proceed with the investigation.

SEC. 7. Correspondence between the sub-committee and the applicant must be carried on through the office of the Secretary, in order that the official records shall be complete.

SEC. 8. Sub-committees shall whenever possible make direct examination and tests of the subject under investigation, and shall not accept tests, data or information furnished by others without first satisfying themselves as to the accuracy thereof. They shall in no case recommend an award solely on the basis of tests, data or information furnished by parties in any way interested in the subject of the award. When data submitted by persons not members of the sub-committee are included in the latter's report, it shall be so stated.

SEC. 9. Sub-committees must ascertain that articles, processes, products, etc., examined are genuine samples of the subject under investigation.

SEC. 10. Each sub-committee on investigation shall report its progress to the Committee at intervals of not more than two consecutive stated meetings; and any sub-committee failing so to report for four consecutive stated meetings may be discharged from further consideration of the subject at the discretion of the Chairman, who shall then appoint a new sub-committee to continue the investigation.

SEC. 11. Any member of a sub-committee on investigation failing to discharge his duties may be replaced by another member at the discretion of the Chairman.

SEC. 12. Sub-committees may request applicants to furnish drawings, diagrams or other exhibits for the purpose of investigations and for the records of the Committee.

SEC. 13. When it is found that the subject under investigation has become involved in litigation, the sub-committee shall defer further action until the litigation is terminated, or the Committee decides that the sub-committee may proceed.

ARTICLE VI.—*Sub-Committee Meetings.*

SECTION 1. A quorum for the transaction of business at any meeting of a sub-committee, properly called, shall consist of the one or more members present.

SEC. 2. No applicant or other person interested in the issue of an investigation shall be present at a meeting of a sub-committee or of the Committee except at the invitation of the sub-committee charged with the investigation.

ARTICLE VII.—*Sub-Committees' Reports.*

SECTION 1. Reports of progress and final reports of sub-committees shall be made to the Committee in writing. Final reports shall begin and end substantially as indicated in Form B.

SEC. 2. When a sub-committee on investigation deems the subject upon which it reports worthy of an award of the Elliott Cresson Medal, the Howard N. Potts Medal, the Edward Longstreth Medal, or the Certificate of Merit, it shall include in its report a recommendation to that effect; and such recommendation may be adopted by a majority vote of the Committee, but shall not be changed except by a vote of two-thirds of the members present.

SEC. 3. A report of a sub-committee on investigation, before its acceptance by the Committee, may be edited by the Secretary of the Institute in conjunction with the chairman of the sub-committee, but without materially changing its meaning or effect. The Secretary and chairman may be assisted in this work by the Publications Committee of the Institute, or by an editing committee appointed by the Chairman of the Committee.

SEC. 4. A report of a sub-committee on investigation, before its acceptance by the Committee, shall be signed by a majority of the members of the sub-committee charged with the investigation.

SEC. 5. Any member or members of a sub-committee may file a minority report at least three days prior to the meeting at which the majority report is to be presented.

SEC. 6. No member of a sub-committee shall be permitted to sign a report without having personally examined the subject under investigation, or taken part in its discussion at a meeting of the sub-committee.

SEC. 7. Reports of sub-committees on investigation shall be accompanied by such drawings, diagrams or other exhibits as will serve to elucidate the subject.

SEC. 8. All exhibits pertaining to reports shall be numbered, marked for identification, and signed by the Secretary of the Institute in substantially the following form, and the seal of the Institute shall be impressed thereon:—

Exhibit No. ———, pertaining to report of the Committee on Science and the Arts No. ———

Secretary.

SEC. 9. Reports must be in the Secretary's hands at least one week previous to the stated meeting at which they are to be presented.

SEC. 10. After the report of a sub-committee on investigation has passed its first reading before the Committee, a copy of it may be furnished the applicant, who may make any explanation or objections, in writing, addressed to the Chairman of the Committee; but such writing must be received not later than the next stated meeting of the Committee.

SEC. 11. The report of a sub-committee on investigation may be discussed and amended at the meeting of the Committee at which it is first presented, but shall be laid over for a second reading and final action until the next stated meeting; except where no recommendation of an award is made in the report, when it may, by a majority vote, be finally disposed of after first reading.

SEC. 12. Final action on a report of a sub-committee on investigation recommending an award shall not be taken unless at least one member of the sub-committee who signed the report is present.

ARTICLE VIII.—*Notices of Recommendations.*

SECTION 1. In the case of investigations made upon application, it shall be the duty of the Secretary to certify to applicants the recommendations of the sub-committee within ten days after this recommendation is adopted by the Committee.

ARTICLE IX.—*Reconsideration.*

SECTION 1. Upon the adoption of a report of a sub-committee a motion for reconsideration may not be made before the stated meeting following. If such a motion is then made and accepted, a vote of two-thirds of a quorum for final action shall be required to change the report previously adopted.

SEC. 2. A second investigation of a subject shall not be ordered unless on a vote of two-thirds of the members present at a stated meeting.

ARTICLE X.—*Advertisement of Recommendations.*

SECTION 1. Upon the adoption, by the Committee on Science and the Arts, of a report of a sub-committee on investigation setting forth a discovery, invention, improvement or manufacture is worthy of an award of the Elliott Cresson Medal, publication shall be made in three successive issues of the JOURNAL of The Franklin Institute, stating that at the expiration of three months from the date of the first publication, the person who has done such discovery, invention, improvement or manufacture shall be entitled to receive the award of the said medal, unless within that time satisfactory evidence shall have been submitted to the Committee on Science and the Arts of the want of originality or merit, in the supposed discovery, invention, improvement, or manufacture.

SEC. 2. Upon the adoption by the Committee on Science and the Arts of a report of a sub-committee on investigation setting forth that distinguished work in science or the arts is worthy of an award of the Howard N. McCoy Medal, publication shall be made in three successive issues of the JOURNAL of The Franklin Institute, stating that at the expiration of three months from the date of the first publication, the person who has done such work shall be entitled to receive the award of the said medal, unless within that time satisfactory evidence shall have been submitted to the Committee on Science and the Arts of the want of originality or merit in the supposed distinguished work in science and the arts.

SEC. 3. The adoption by the Committee on Science and the Arts of a report of a sub-committee recommending an award of the Franklin Medal shall be conclusive without advertisement.

SEC. 4. The adoption by the Committee on Science and the Arts of a report of a sub-committee recommending an award of the Edward Longstreth Medal shall be conclusive without advertisement.

SEC. 5. The adoption by the Committee on Science and the Arts of a report of a sub-committee recommending an award of the Certificate of Merit shall be conclusive without advertisement.

ARTICLE XI.—*Protests.*

SECTION 1. Protests against recommendations advertised by publication in the JOURNAL must be received within three months of the date of first publication. Such protests shall be presented to the Committee at its next stated meeting following date of receipt, and shall be affirmed only by a vote of two-thirds of a quorum for final action, in which case a re-investigation shall be made.

ARTICLE XII.—*Institute Reports.*

SECTION 1. Reports issued by the Institute shall begin and end substantially as in Form C below. They shall be written upon an official form provided by the Institute.

SEC. 2. Reports when issued shall state that they are the action of The Franklin Institute by its Committee on Science and the Arts. They shall be attested by the President and the Secretary of the Institute and by the Chairman of the Committee, and shall be impressed with the seal of the Institute; and they may also bear the names of the members who signed the sub-committee's report.

SEC. 3. It shall be the duty of the Secretary to furnish applicants for investigation with a copy of the Institute's Report.

ARTICLE XIII.—*Amendments to Regulations.*

SECTION 1. Proposals to amend these regulations shall be presented to the Committee in writing, signed by at least two members. They may be considered when presented, but shall not be acted upon until the next stated meeting after presentation, and shall then be adopted if agreed to by two-thirds of the required quorum.

SEC. 2. Notice of proposed amendments shall be sent to each member on the programme for the meeting at which they may be acted upon.

A special committee, appointed for the purpose of preparing a memorandum covering the practice of the committee in the matter of recommending the different awards available to the Institute, presented a detailed report at the Stated Meeting on September 1, 1920, of which the following are the conclusions:

Since much latitude is allowed by the terms of the several medal bequests and no rules for the making of Institute awards conflicting with the purpose and intent of the donors can be made, it is obviously not the part of wisdom to attempt too much in the way of definition but your Committee is of the opinion that future awards might be made with the following general understanding:

1. That the Certificate of Merit be awarded for meritorious inventions, physical processes, and JOURNAL contributions of substantial merit, but not of such merit as would warrant the award of a medal.

2. That the Edward Longstreth Medal be awarded for invention of high order and for particularly meritorious improvements and developments in machines and mechanical processes.

3. That the Howard N. Potts Medal be awarded in recognition of important discoveries in physical science and JOURNAL contributions of the first rank.

4. That the Elliott Cresson Medal be awarded in recognition of inventions of signal value and fundamentally important in the arts and industries.

5. That the Franklin Medal continue to be awarded to those whose efforts have contributed most to a knowledge of physical science and its applications.

REPORT FORMS OF COMMITTEE ON SCIENCE AND THE ARTS

FORM A

(Application for Investigation)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

In the matter of your application to The Franklin Institute for a consideration of your invention or discovery entitled
..... the following data are requested for the information of the Committee on Science and the Arts:

1. What is the specific purpose of the invention?
2. What is the condition of the prior art in this regard?
3. What improvement is claimed to be effected by the invention?
4. How is the improvement effected?
5. What patents, if any, have been issued for this invention?
6. What citations, if any, were made in this regard by the Patent Office before allowance of patent claims?
7. Is the invention now in actual use?
8. If so, since when?
9. Where may it be seen in operation?
10. Are you prepared to submit drawings of the apparatus or device?
11. Are you prepared to submit a model of the apparatus or device?
12. If the invention is a composition of matter, are you prepared to submit specimens of the ingredients and of the compound sufficient for the purpose of experiments?
13. If the invention is a chemical process, are you prepared to give a demonstration of the same?

IMPORTANT TO APPLICANT

This application carefully filled in and other available matters descriptive of the invention or process together with two copies of each of the United States patents issued to applicant must be returned promptly to the Secretary of The Franklin Institute, 15 South Seventh Street, Philadelphia, Pa.

(A copy of Form A, above, may be obtained from the Secretary of the Institute and must be filled in, signed and promptly returned by an applicant for an examination of and a report upon an invention or discovery.)

FORM B
(Sub-committee Report Form)
THE FRANKLIN INSTITUTE
OF THE
STATE OF PENNSYLVANIA
FOR THE
PROMOTION OF THE MECHANIC ARTS

S. & A. Case No.

REPORT OF SUB-COMMITTEE, dated

Investigating

TO THE COMMITTEE ON SCIENCE AND THE ARTS:

Your sub-committee appointed to investigate the above subject report as follows:

.....

In consideration of the { discovery
excellence of construction
ingenuity and novelty
or

of your sub-committee recommends

the award of to of

Respectfully submitted,

..... *Chairman*

.....

.....

.....

Adopted at the Stated Meeting of 19

YEAR BOOK OF

FORM C

(Institute Report Forms)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

HALL OF THE INSTITUTE,

Philadelphia,

S. & A. Case No.

The Franklin Institute of the State of Pennsylvania, acting through its
Committee on Science and the Arts, investigating

..... reports as follows:

.....

In consideration of the { discovery
excellence of construction
ingenuity and novelty
or

ofthe Institute awards the

.....

to of

..... *President.*

[SEAL]

..... *Secretary.*

Countersigned

Chairman of the Committee on Science and the Arts.

PRESIDENT'S REPORT AND REPORTS OF THE COMMITTEES OF THE INSTITUTE AND THE COMMITTEES OF ITS BOARD OF MANAGERS.

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

REPORT OF THE PRESIDENT

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

To the Members of The Franklin Institute:

This writing is the report which your Board of Managers has instructed me to make to you upon the affairs of the Institute for the year ending September 30, 1920.

The Institute year covered by this report was unusual in some respects, as you may learn from reading the reports of the several committees of the Board and of the Institute, as they will appear in the 1921 Year Book. For your immediate information we quote briefly from the reports, and comment upon such matters in connection with them as it seems important to call to your especial attention.

The Library Committee, Doctor Creighton, Chairman, reports additions to the library of 2508 volumes and pamphlets. This is an increase of about 400 as compared with the previous year. In addition to these additions to the library as held in the Institute building, we have received and placed in a fireproof warehouse for temporary storage, the great sugar library bequeathed to the Institute by Mr. Lewis S. Ware—about 25,000 volumes and pamphlets. The convenient disposal of this great collection of books awaits the acquisition of a new and much larger building wherein to house our library and our other possessions and activities.

The report of the Committee on Meetings, Doctor Alleman, Chairman, makes brief reference to the lectures delivered during the year at the stated meetings of the Institute, and to the awarding of The Franklin Medal to Sir Charles A. Parsons, of steam turbine fame, and to the great Scandinavian scientist, Professor Arrhenius. Our May meeting was distinguished by the presence of Sir Auckland Geddes, British Ambassador to the United States, and of Mr. Joen de Lagerberg, of the Swedish Legation.

The report of the Committee on Instruction, Mr. Paul, Chairman, records the largest attendance so far of record in the history of our schools. Not only were our facilities taxed to the utmost by the scholars we received, but we were compelled to deny admittance to many. It was a highly satisfactory school year—both in the number of scholars and in the interest shown by students and by teachers.

The Committee on Election and Resignation of Members reports the election of sixty-seven new members, and the loss through resignation, death and otherwise, of eighty-three members. The membership of the Institute

disappointing little. At the close of the year covered by the report we were thirteen hundred eighty strong, and in what must be regarded as an otherwise very satisfactory Institute year, our net membership was reduced by seven. Never in the fifteen years of my experience as an executive had we better or better attended lectures, or more satisfactory results from our educational efforts, nor did our important Publications Committee do more than its work; and certainly our financial situation never showed greater improvement than during the twelve months under consideration. Yet, with all this record of high achievement and prosperity, and in spite of the best efforts of the Committee on Membership, we did not quite hold our own in numbers. This is about the customary condition as of recent years. I think we can anticipate that the people of Philadelphia will not awake to the advantages of membership in The Franklin Institute, or to the importance of the service it is rendering, until the existence of the Institute is more forcibly forced upon their notice, as it will be when our activities are transferred to a more prominent location.

The Committee on Publications, Mr. Rosengarten, Chairman, reports the year's activities at a regrettable but unavoidable increase in cost. We say "regrettable" because we regard it fixed that the high character of the work shall be maintained at whatever cost. Certainly this year we are glad to meet the expense incident to maintaining this standard.

The Publications Committee embarked during the year upon an important enterprise, in a sense new to the Institute. With the approval of the Board of Managers, the Committee has published in book form Dr. W. J. Humphreys' great work—"The Physics of the Air." This work is based upon a series of articles appearing in the JOURNAL during the past three years. It is believed to be the most important contribution in the branch of subjects of which it treats that ever has been made to the literature of the world. It is the first publication of its kind gotten out by the Institute; and, regarded either as a contribution to the knowledge of the world, or as an example of the printers' and binders' art, it sets a high standard—the standard we strive for and like to think is achieved in the work of the Institute in whatever department.

The Committee on Sectional Arrangements, Dr. Keller, Chairman, reports a series of successful meetings of the sections, with nineteen lectures, each by a lecturer distinguished in his branch of science. These lectures were well attended—mainly by people learned in the art or science discussed. The character of our audiences—largely specialists, teachers and students in the science under discussion, is indicative of the service these lectures are rendering to the mechanic arts as practiced and to artisans as practicing in Philadelphia.

The Committee on Science and the Arts, Mr. Penrose, Chairman, reports twenty-two cases investigated and finished during the year, and seventeen cases pending at the close of the year. This bare statement is far from telling the full story of the activities of the Science and Arts Committee.

We here interrupt the natural course of this report to say that the Board of Managers hope that the members of the Institute will read the full report

of the Science and Arts Committee and of the other committees as they will appear in the Year Book, that they may know whether they should be satisfied with the amount and kind and character of the work being done by or under the direction of their elected officers. We think that in no other way may you obtain so large a measure of information about the work of your Institute.

The Committee on Museums, Mr. Outerbridge, Chairman, reports additions to our collection of objects of interest, of several articles that have high value as relics of men once great in science and art, and long since departed. One of these—the air pump of Dr. Joseph Priestley, presented to the Institute by Mr. Coleman Sellers, Jr., is before you as you listen to the reading of this report.

We learn from the report of the Committee on Exhibitions, Mr. Franklin, Chairman, that a representative of the Institute—the Chairman of the Committee—has been present at such meetings as have been held at the City Hall for the discussion of the proposal to hold an international exhibition in Philadelphia in 1926—the 150th anniversary of the signing of the Declaration of Independence. The President of the Institute has been appointed on the Mayor's Committee of One Hundred charged with the formulation and execution of plans in connection therewith, if, upon further study, the project prove to be practicable.

It is proper in this connection to make reference to our own approaching one hundredth anniversary. In 1924, three years from now, the Institute will have rounded out a century of life—one hundred years of fine performance, rich in traditions of good work. We will soon have to consider how fittingly to observe the centenary of our founding; how we may best so show honor to the memory of the founders and to the generations of men who have carried on the work so nobly begun by the founders as to inspire their successors of our generation, and among them ourselves, to a self-sacrificing emulation. Your Board of Managers will again call your attention to this matter, that at the proper time suitable action may be inaugurated.

The report of the Committee on Endowment, Mr. Sellers, Chairman, refers to the bequest of Lewis S. Ware—\$20,000—for the maintenance of the Ware Library, and \$20,000 for the new building fund, and concludes thus: "The Endowment Committee was chiefly concerned during the year with negotiations in connection with the bequest of Henry W. Bartol and the Committee is happy to report that compromises were reached with the widow and the two daughters on terms which were favorable to the Institute. All opposition is withdrawn and there is now no obstacle to prevent an early settlement of the Estate."

At your December meeting you instructed the President to appoint, with the approval of the Board, a committee of five members—the President and Secretary being *ex officio* members—"to carry into effect the intent and purposes of the Henry W. Bartol bequest to The Franklin Institute." The committee has been formed and approved by the Board of Managers. Its membership is:

Charles Day, Vice-President of the Institute.

fluctuates little. At the close of the year covered by the report we were thirteen hundred eighty strong, and in what must be regarded as an otherwise very satisfactory Institute year, our net membership was reduced by sixteen. Never in the fifteen years of my experience as an executive had we better or better attended lectures, or more satisfactory results from our educational efforts, nor did our important Publications Committee do more notable work; and certainly our financial situation never showed greater improvement than during the twelve months under consideration. Yet, with this record of high achievement and prosperity, and in spite of the best efforts of the Committee on Membership, we did not quite hold our own in numbers. This is about the customary condition as of recent years. I think we may anticipate that the people of Philadelphia will not awake to the advantages of membership in The Franklin Institute, or to the importance of the service it is rendering, until the existence of the Institute is more frequently forced upon their notice, as it will be when our activities are housed in a more prominent location.

The Committee on Publications, Mr. Rosengarten, Chairman, reports the usual activities at a regrettable but unavoidable increase in cost. We say "unavoidable" because we regard it fixed that the high character of the JOURNAL shall be maintained at whatever cost. Certainly this year we are able to meet the expense incident to maintaining this standard.

The Publications Committee embarked during the year upon an important enterprise, in a sense new to the Institute. With the approval of the Board of Managers, the Committee has published in book form Dr. W. J. Humphreys' great work—"The Physics of the Air." This work is based upon a series of articles appearing in the JOURNAL during the past three years. It is believed to be the most important contribution in the branch of physics of which it treats that ever has been made to the literature of the world. It is the first publication of its kind gotten out by the Institute; and, regarded either as a contribution to the knowledge of the world, or as an example of the printers' and binders' art, it sets a high standard—the standard we strive for and like to think is achieved in the work of the Institute in whatever department.

The Committee on Sectional Arrangements, Dr. Keller, Chairman, reports a series of successful meetings of the sections, with nineteen lectures, each by a lecturer distinguished in his branch of science. These lectures were well attended—mainly by people learned in the art or science discussed. The character of our audiences—largely specialists, teachers and students in the art or science under discussion, is indicative of the service these lectures are rendering to the mechanic arts as practiced and to artisans as practicing in Philadelphia.

The Committee on Science and the Arts, Mr. Penrose, Chairman, reports twenty-two cases investigated and finished during the year, and seventeen cases pending at the close of the year. This bare statement is far from carrying the full story of the activities of the Science and Arts Committee.

We here interrupt the natural course of this report to say that the Board of Managers hope that the members of the Institute will read the full report

of the Science and Arts Committee and of the other committees as they will appear in the Year Book, that they may know whether they should be satisfied with the amount and kind and character of the work being done by or under the direction of their elected officers. We think that in no other way may you obtain so large a measure of information about the work of your Institute.

The Committee on Museums, Mr. Outerbridge, Chairman, reports additions to our collection of objects of interest, of several articles that have high value as relics of men once great in science and art, and long since departed. One of these—the air pump of Dr. Joseph Priestley, presented to the Institute by Mr. Coleman Sellers, Jr., is before you as you listen to the reading of this report.

We learn from the report of the Committee on Exhibitions, Mr. Franklin, Chairman, that a representative of the Institute—the Chairman of the Committee—has been present at such meetings as have been held at the City Hall for the discussion of the proposal to hold an international exhibition in Philadelphia in 1926—the 150th anniversary of the signing of the Declaration of Independence. The President of the Institute has been appointed on the Mayor's Committee of One Hundred charged with the formulation and execution of plans in connection therewith, if, upon further study, the project prove to be practicable.

It is proper in this connection to make reference to our own approaching one hundredth anniversary. In 1924, three years from now, the Institute will have rounded out a century of life—one hundred years of fine performance, rich in traditions of good work. We will soon have to consider how fittingly to observe the centenary of our founding; how we may best so show honor to the memory of the founders and to the generations of men who have carried on the work so nobly begun by the founders as to inspire their successors of our generation, and among them ourselves, to a self-sacrificing emulation. Your Board of Managers will again call your attention to this matter, that at the proper time suitable action may be inaugurated.

The report of the Committee on Endowment, Mr. Sellers, Chairman, refers to the bequest of Lewis S. Ware—\$20,000—for the maintenance of the Ware Library, and \$20,000 for the new building fund, and concludes thus: "The Endowment Committee was chiefly concerned during the year with negotiations in connection with the bequest of Henry W. Bartol and the Committee is happy to report that compromises were reached with the widow and the two daughters on terms which were favorable to the Institute. All opposition is withdrawn and there is now no obstacle to prevent an early settlement of the Estate."

At your December meeting you instructed the President to appoint, with the approval of the Board, a committee of five members—the President and Secretary being *ex officio* members—"to carry into effect the intent and purposes of the Henry W. Bartol bequest to The Franklin Institute." The committee has been formed and approved by the Board of Managers. Its membership is:

Charles Day, Vice-President of the Institute.

Coleman Sellers, Jr., Vice-President of the Institute.

C. C. Tutwiler, Member of the Board.

Arthur L. Day, Ph.D., Director of Geophysical Laboratory, Carnegie Institution, Washington, D. C.

Joseph S. Ames, Ph.D., LL.D., Director of Physical Laboratory, Johns Hopkins University, Baltimore, Md.

The President and Secretary of the Institute—*ex officio*. The appointed members have accepted the duty imposed, and the Committee will meet in the near future.

The report of the Committee on Stocks and Finance, Mr. Forstall, Chairman, presents a statement of receipts and expenditures for the year that should prove interesting and gratifying to each member and friend of the Institute. Its closing paragraph contains the statement that during the year there was an increase in the balance of assets over liabilities of \$51,974.54. We may not reasonably expect each year to show an increase in this balance, but, if we may judge the future by the past—if we may expect the character of our work to commend itself in the future as in the past it has commended itself to people seeking to dedicate their savings to a public good, we may safely count on such support as will insure through the coming decades the maintenance of the Institute and its activities, however any single year's balance sheet may disappoint us.

In the past we have had years lean indeed. Today we may be said to prosper. Because we have believed that such work as we could perform would find, over a period of years, ample financial support, we have had faith to carry on our work at times when to carry on meant living on our accumulated funds or going into debt, or both. But never have we so ordered our affairs as to render in any degree precarious the claims of those to whom we might become financially indebted. It has been the policy of your Board to do the work for which your Institute was created as long as there were available funds or saleable property or bank credit; never to the extent of placing creditors in peril or of using trust funds other than as designed by their owners, but otherwise to the limit of possibility. We believed that such a course would commend itself to people with savings to devote to a public good, and that our work would be supported. And the event has proven the wisdom of the course. Our work has been supported. The fears of any who may have had contrary opinions have not been justified. People seeking to invest their money for a public good have looked with favor upon your Institute as an instrument. Funds have come to us. In the face of the enormous increase in the recent cost of doing any kind of work the Institute has carried on its work undiminished. The funds that in recent times have come to us have supported us in our activities, and have greatly increased our endowments in addition to paying the debts incurred in the lean years—years when, poor in money but rich in faith, the membership endorsed our policies and shared our responsibilities. This current year, 1921, the Institute will be out of debt, other than the debt of one department to another. It is a condition none of us can remember as previously existing in the affairs of the Institute. The funds that have come to us from gifts

or bequests have mostly been dedicated to endowment rather than for operating costs. So, although our funds had previously increased much more than sufficiently to pay the debts incurred in our lean years, it is only this past year that our funds applicable to operating have been sufficient for the cancellation of our debts.

As written above, we may not expect each year to be so free as now from financial anxieties. But, as over a period of years, we have no doubt that as we maintain the Institute's activities in accord with the traditions that have been growing for nearly a century in this old building, we will be given the means necessary to their indefinite continuance. This has proven true of four generations of men. With a full appreciation of their quality, let us strengthen our resolution that for the fraction of the Institute's life in which its affairs are in our custody these affairs shall be so ordered that they who follow us may judge us to have been not altogether unworthy successors of the notable men once workers within these walls now long gone to their reward. Thus only can we be justified in accepting the trust of the generous men and women who, seeking the promotion of the mechanic arts, have chosen The Franklin Institute to be the almoner of their bounty.

Respectfully submitted,

By order of the Board of Managers,

WALTON CLARK,

President.

PHILADELPHIA, January 12, 1921.

REPORT OF THE COMMITTEE ON LIBRARY.

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

[ABSTRACT.]

To the President and Members of The Franklin Institute:

The Committee on Library respectfully submits the following statement of the activities in the library during the year ending September 30, 1920:

The additions to the library were as follows:

| Source | Bd. Vols. | Unb. Vols. | Pp's | Photographs | Maps |
|------------------------|-----------|------------|------------|-------------|---------|
| By Gift | 208 | 275 | 1373 | 9 | 1 |
| Binding | 227 | | | | |
| JOURNAL | 32 | 21 | | | 1 |
| Purchase: | | | | | |
| Books and Periodicals | | | | | |
| Acc't. | 8 | 1 | | | |
| Lea Fund | 68 | 23 | | | 1 |
| Memorial Library Fund. | 2 | | | | |
| Miscellaneous Expense | | | | | |
| Acc't. | | | 2 | | |
| Moore Fund | 109 | 9 | 3 | | |
| Morris Fund | 24 | 2 | | | |
| Potts Fund | 18 | | | | |
| Ware Fund | 1 | | | | |
| | <hr/> 787 | <hr/> 331 | <hr/> 1378 | <hr/> 9 | <hr/> 3 |

Total additions for the year 2508
an increase of 379 titles over the previous year.

The Committee had at its disposal \$2890.00, appropriated by the Board of Managers and \$3900.32 being the income of the various trust funds.

The expenditures for the year were \$1601.91 for subscriptions to magazines and other periodical publications, \$768.75 for binding, \$2023.06 for books and \$107.61 for general expenses.

Donors:

Gifts of books, pamphlets and magazines in large quantities or of special value were given by Messrs. H. M. Bary, J. T. Butler, Charles E. Duryea, W. Copeland Furber, F. Lynwood Garrison, Henry Howson, Howard S. Levy, J. H. Mulligan, Lawrence T. Paul, Dr. Paul J. Sartain, Mrs. H. B. Hackett, Messrs. Harris and Richards, Mrs. E. H. Kanitz of New York City and the Shoemaker-Satterthwaite Bridge Company.

Dr. Edward G. Acheson presented the library with a year's subscription to *Forbes' Magazine* and Mr. Henry Howson, in addition to a gift of about 1000 volumes, presented a desk which has been placed in the reading room.

The contents of the library on September 30, 1920, were as follows:

Volumes, bound and unbound 74,668

| | |
|-----------------------|--------|
| Pamphlets | 16,597 |
| Maps and charts | 2,292 |
| Photographs | 1,349 |

Binding:

The following work was done by the binders during the year:

| | Volumes |
|---|-----------|
| Recent Periodicals | 224 |
| Recent unbound books | 4 |
| Old Volumes, bound, rebound and repaired..... | 16 |
| | <hr/> 244 |

Because of unusually high costs the number of volumes bound was less than one-half the number of the previous year. We look forward to a reduction in prices during the next few months and hope to be able to present a more satisfactory statement on the activities of this department of the library in our next report.

Periodicals:

The total number of periodical publications received by exchange, gift or purchase was 788.

Evening Hours:

The library was open until ten o'clock on 39 evenings during the winter months.

Respectfully submitted,

H. JERMAIN CREIGHTON,

Chairman.

PHILADELPHIA, January 12, 1921.

REPORT OF THE COMMITTEE ON MUSEUM.

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

To the President and Members of The Franklin Institute:

The following have been added to the Institute's collections during the period covered by this report:

Miniature of Dr. William H. Keating, one of the founders of the Institute. Painted by Mr. Hugh Bridport, first instructor in the Department of Free-hand Drawing of the Institute's school. Presented to the Institute by Mr. J. Percy Keating.

Silver Medal of The Franklin Institute exhibition of 1824, awarded to Mr. Joseph Swartz for specimens of domestic carpeting. Presented to the Institute by Mr. Arthur C. Chancellor, an alumnus of the Institute's School of Mechanic Arts.

Will of General George Washington printed from the records of the County Court of Fairfax, 1780, forty days after the General's death. Pamphlet of thirty-two pages. Presented by Mr. Arthur C. Chancellor, an alumnus of

1. That the Certificate of Merit be awarded for meritorious inventions, physical processes, and JOURNAL contributions of substantial merit, but not of such merit as would warrant the award of a medal.

2. That the Edward Longstreth Medal be awarded for invention of high order and for particularly meritorious improvements and developments in machines and mechanical processes.

3. That the Howard N. Potts Medal be awarded in recognition of important discoveries in physical science and JOURNAL contributions of the first rank.

4. That the Elliott Cresson Medal be awarded in recognition of inventions of signal value and fundamentally important in the arts and industries.

5. That the Franklin Medal continue to be awarded to those whose efforts have contributed most to a knowledge of physical science and its applications.

REPORT FORMS OF COMMITTEE ON SCIENCE AND THE ARTS

FORM A

(Application for Investigation)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

In the matter of your application to The Franklin Institute for a consideration of your invention or discovery entitled
..... the following data are requested for the information of the Committee on Science and the Arts:

1. What is the specific purpose of the invention?
2. What is the condition of the prior art in this regard?
3. What improvement is claimed to be effected by the invention?
4. How is the improvement effected?
5. What patents, if any, have been issued for this invention?
6. What citations, if any, were made in this regard by the Patent Office before allowance of patent claims?
7. Is the invention now in actual use?
8. If so, since when?
9. Where may it be seen in operation?
10. Are you prepared to submit drawings of the apparatus or device?
11. Are you prepared to submit a model of the apparatus or device?
12. If the invention is a composition of matter, are you prepared to submit specimens of the ingredients and of the compound sufficient for the purpose of experiments?
13. If the invention is a chemical process, are you prepared to give a demonstration of the same?

IMPORTANT TO APPLICANT

This application carefully filled in and other available matters descriptive of the invention or process together with two copies of each of the United States patents issued to applicant must be returned promptly to the Secretary of The Franklin Institute, 15 South Seventh Street, Philadelphia, Pa.

(A copy of Form A, above, may be obtained from the Secretary of the Institute and must be filled in, signed and promptly returned by an applicant for an examination of and a report upon an invention or discovery.)

FORM B
(Sub-committee Report Form)
THE FRANKLIN INSTITUTE
OF THE
STATE OF PENNSYLVANIA
FOR THE
PROMOTION OF THE MECHANIC ARTS

S. & A. Case No.

REPORT OF SUB-COMMITTEE, dated

Investigating

TO THE COMMITTEE ON SCIENCE AND THE ARTS:

Your sub-committee appointed to investigate the above subject report as follows:

.....

In consideration of the { discovery
excellence of construction
ingenuity and novelty
or

of your sub-committee recommends

the award of to of

Respectfully submitted,

..... Chairman.

.....

.....

.....

Adopted at the Stated Meeting of 19

YEAR BOOK OF

FORM C

(Institute Report Forms)

THE FRANKLIN INSTITUTE
OF THE
STATE OF PENNSYLVANIA
FOR THE
PROMOTION OF THE MECHANIC ARTS

HALL OF THE INSTITUTE,

Philadelphia,

S. & A. Case No.

The Franklin Institute of the State of Pennsylvania, acting through its
Committee on Science and the Arts, investigating
..... reports as follows:

.....
In consideration of the { discovery
excellence of construction
ingenuity and novelty
or

ofthe Institute awards the
.....
to..... of

[SEAL]

..... *President.*..... *Secretary.*

Countersigned

Chairman of the Committee on Science and the Arts.

PRESIDENT'S REPORT AND REPORTS OF THE COMMITTEES OF THE INSTITUTE AND THE COMMITTEES OF ITS BOARD OF MANAGERS.

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

REPORT OF THE PRESIDENT

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

To the Members of The Franklin Institute:

This writing is the report which your Board of Managers has instructed me to make to you upon the affairs of the Institute for the year ending September 30, 1920.

The Institute year covered by this report was unusual in some respects, as you may learn from reading the reports of the several committees of the Board and of the Institute, as they will appear in the 1921 Year Book. For your immediate information we quote briefly from the reports, and comment upon such matters in connection with them as it seems important to call to your especial attention.

The Library Committee, Doctor Creighton, Chairman, reports additions to the library of 2508 volumes and pamphlets. This is an increase of about 400 as compared with the previous year. In addition to these additions to the library as held in the Institute building, we have received and placed in a fireproof warehouse for temporary storage, the great sugar library bequeathed to the Institute by Mr. Lewis S. Ware—about 25,000 volumes and pamphlets. The convenient disposal of this great collection of books awaits the acquisition of a new and much larger building wherein to house our library and our other possessions and activities.

The report of the Committee on Meetings, Doctor Alleman, Chairman, makes brief reference to the lectures delivered during the year at the stated meetings of the Institute, and to the awarding of The Franklin Medal to Sir Charles A. Parsons, of steam turbine fame, and to the great Scandinavian scientist, Professor Arrhenius. Our May meeting was distinguished by the presence of Sir Auckland Geddes, British Ambassador to the United States, and of Mr. Joen de Lagerberg, of the Swedish Legation.

The report of the Committee on Instruction, Mr. Paul, Chairman, records the largest attendance so far of record in the history of our schools. Not only were our facilities taxed to the utmost by the scholars we received, but we were compelled to deny admittance to many. It was a highly satisfactory school year—both in the number of scholars and in the interest shown by students and by teachers.

The Committee on Election and Resignation of Members reports the election of sixty-seven new members, and the loss through resignation, death and otherwise, of eighty-three members. The membership of the Institute

fluctuates little. At the close of the year covered by the report we were thirteen hundred eighty strong, and in what must be regarded as an otherwise very satisfactory Institute year, our net membership was reduced by sixteen. Never in the fifteen years of my experience as an executive had we better or better attended lectures, or more satisfactory results from our educational efforts, nor did our important Publications Committee do more notable work; and certainly our financial situation never showed greater improvement than during the twelve months under consideration. Yet, with this record of high achievement and prosperity, and in spite of the best efforts of the Committee on Membership, we did not quite hold our own in numbers. This is about the customary condition as of recent years. I think we may anticipate that the people of Philadelphia will not awake to the advantages of membership in The Franklin Institute, or to the importance of the service it is rendering, until the existence of the Institute is more frequently forced upon their notice, as it will be when our activities are housed in a more prominent location.

The Committee on Publications, Mr. Rosengarten, Chairman, reports the usual activities at a regrettable but unavoidable increase in cost. We say "unavoidable" because we regard it fixed that the high character of the JOURNAL shall be maintained at whatever cost. Certainly this year we are able to meet the expense incident to maintaining this standard.

The Publications Committee embarked during the year upon an important enterprise, in a sense new to the Institute. With the approval of the Board of Managers, the Committee has published in book form Dr. W. J. Humphreys' great work—"The Physics of the Air." This work is based upon a series of articles appearing in the JOURNAL during the past three years. It is believed to be the most important contribution in the branch of physics of which it treats that ever has been made to the literature of the world. It is the first publication of its kind gotten out by the Institute; and, regarded either as a contribution to the knowledge of the world, or as an example of the printers' and binders' art, it sets a high standard—the standard we strive for and like to think is achieved in the work of the Institute in whatever department.

The Committee on Sectional Arrangements, Dr. Keller, Chairman, reports a series of successful meetings of the sections, with nineteen lectures, each by a lecturer distinguished in his branch of science. These lectures were well attended—mainly by people learned in the art or science discussed. The character of our audiences—largely specialists, teachers and students in the art or science under discussion, is indicative of the service these lectures are rendering to the mechanic arts as practiced and to artisans as practicing in Philadelphia.

The Committee on Science and the Arts, Mr Penrose, Chairman, reports twenty-two cases investigated and finished during the year, and seventeen cases pending at the close of the year. This bare statement is far from carrying the full story of the activities of the Science and Arts Committee.

We here interrupt the natural course of this report to say that the Board of Managers hope that the members of the Institute will read the full report

of the Science and Arts Committee and of the other committees as they will appear in the Year Book, that they may know whether they should be satisfied with the amount and kind and character of the work being done by or under the direction of their elected officers. We think that in no other way may you obtain so large a measure of information about the work of your Institute.

The Committee on Museums, Mr. Outerbridge, Chairman, reports additions to our collection of objects of interest, of several articles that have high value as relics of men once great in science and art, and long since departed. One of these—the air pump of Dr. Joseph Priestley, presented to the Institute by Mr. Coleman Sellers, Jr., is before you as you listen to the reading of this report.

We learn from the report of the Committee on Exhibitions, Mr. Franklin, Chairman, that a representative of the Institute—the Chairman of the Committee—has been present at such meetings as have been held at the City Hall for the discussion of the proposal to hold an international exhibition in Philadelphia in 1926—the 150th anniversary of the signing of the Declaration of Independence. The President of the Institute has been appointed on the Mayor's Committee of One Hundred charged with the formulation and execution of plans in connection therewith, if, upon further study, the project prove to be practicable.

It is proper in this connection to make reference to our own approaching one hundredth anniversary. In 1924, three years from now, the Institute will have rounded out a century of life—one hundred years of fine performance, rich in traditions of good work. We will soon have to consider how fittingly to observe the centenary of our founding; how we may best so show honor to the memory of the founders and to the generations of men who have carried on the work so nobly begun by the founders as to inspire their successors of our generation, and among them ourselves, to a self-sacrificing emulation. Your Board of Managers will again call your attention to this matter, that at the proper time suitable action may be inaugurated.

The report of the Committee on Endowment, Mr. Sellers, Chairman, refers to the bequest of Lewis S. Ware—\$20,000—for the maintenance of the Ware Library, and \$20,000 for the new building fund, and concludes thus: "The Endowment Committee was chiefly concerned during the year with negotiations in connection with the bequest of Henry W. Bartol and the Committee is happy to report that compromises were reached with the widow and the two daughters on terms which were favorable to the Institute. All opposition is withdrawn and there is now no obstacle to prevent an early settlement of the Estate."

At your December meeting you instructed the President to appoint, with the approval of the Board, a committee of five members—the President and Secretary being *ex officio* members—"to carry into effect the intent and purposes of the Henry W. Bartol bequest to The Franklin Institute." The committee has been formed and approved by the Board of Managers. Its membership is:

Charles Day, Vice-President of the Institute.

Coleman Sellers, Jr., Vice-President of the Institute.

C. C. Tutwiler, Member of the Board.

Arthur L. Day, Ph.D., Director of Geophysical Laboratory, Carnegie Institution, Washington, D. C.

Joseph S. Ames, Ph.D., LL.D., Director of Physical Laboratory, Johns Hopkins University, Baltimore, Md.

The President and Secretary of the Institute—*ex officio*. The appointed members have accepted the duty imposed, and the Committee will meet in the near future.

The report of the Committee on Stocks and Finance, Mr. Forstall, Chairman, presents a statement of receipts and expenditures for the year that should prove interesting and gratifying to each member and friend of the Institute. Its closing paragraph contains the statement that during the year there was an increase in the balance of assets over liabilities of \$51,974.54. We may not reasonably expect each year to show an increase in this balance, but, if we may judge the future by the past—if we may expect the character of our work to commend itself in the future as in the past it has commended itself to people seeking to dedicate their savings to a public good, we may safely count on such support as will insure through the coming decades the maintenance of the Institute and its activities, however any single year's balance sheet may disappoint us.

In the past we have had years lean indeed. Today we may be said to prosper. Because we have believed that such work as we could perform would find, over a period of years, ample financial support, we have had faith to carry on our work at times when to carry on meant living on our accumulated funds or going into debt, or both. But never have we so ordered our affairs as to render in any degree precarious the claims of those to whom we might become financially indebted. It has been the policy of your Board to do the work for which your Institute was created as long as there were available funds or saleable property or bank credit; never to the extent of placing creditors in peril or of using trust funds other than as designed by their owners, but otherwise to the limit of possibility. We believed that such a course would commend itself to people with savings to devote to a public good, and that our work would be supported. And the event has proven the wisdom of the course. Our work has been supported. The fears of any who may have had contrary opinions have not been justified. People seeking to invest their money for a public good have looked with favor upon your Institute as an instrument. Funds have come to us. In the face of the enormous increase in the recent cost of doing any kind of work the Institute has carried on its work undiminished. The funds that in recent times have come to us have supported us in our activities, and have greatly increased our endowments in addition to paying the debts incurred in the lean years—years when, poor in money but rich in faith, the membership endorsed our policies and shared our responsibilities. This current year, 1921, the Institute will be out of debt, other than the debt of one department to another. It is a condition none of us can remember as previously existing in the affairs of the Institute. The funds that have come to us from gifts

or bequests have mostly been dedicated to endowment rather than for operating costs. So, although our funds had previously increased much more than sufficiently to pay the debts incurred in our lean years, it is only this past year that our funds applicable to operating have been sufficient for the cancellation of our debts.

As written above, we may not expect each year to be so free as now from financial anxieties. But, as over a period of years, we have no doubt that as we maintain the Institute's activities in accord with the traditions that have been growing for nearly a century in this old building, we will be given the means necessary to their indefinite continuance. This has proven true of four generations of men. With a full appreciation of their quality, let us strengthen our resolution that for the fraction of the Institute's life in which its affairs are in our custody these affairs shall be so ordered that they who follow us may judge us to have been not altogether unworthy successors of the notable men once workers within these walls now long gone to their reward. Thus only can we be justified in accepting the trust of the generous men and women who, seeking the promotion of the mechanic arts, have chosen The Franklin Institute to be the almoner of their bounty.

Respectfully submitted,

By order of the Board of Managers,

WALTON CLARK,

President.

PHILADELPHIA, January 12, 1921.

REPORT OF THE COMMITTEE ON LIBRARY.

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

[ABSTRACT.]

To the President and Members of The Franklin Institute:

The Committee on Library respectfully submits the following statement of the activities in the library during the year ending September 30, 1920:

The additions to the library were as follows:

| | Source | Bd. Vols. | Unbd. Vols. | Pphs. | Photographs | Maps |
|------------------------|--------|-----------|-------------|------------|-------------|---------|
| By Gift | | 298 | 275 | 1373 | 9 | 1 |
| Binding | | 227 | | | | |
| JOURNAL | | 32 | 21 | | | 1 |
| Purchase: | | | | | | |
| Books and Periodicals | | | | | | |
| Acc't. | | 8 | 1 | | | |
| Lea Fund | | 68 | 23 | | | 1 |
| Memorial Library Fund. | | 2 | | | | |
| Miscellaneous Expense | | | | | | |
| Acc't. | | | | 2 | | |
| Moore Fund | | 109 | 9 | 3 | | |
| Morris Fund | | 24 | 2 | | | |
| Potts Fund | | 18 | | | | |
| Ware Fund | | 1 | | | | |
| | | <hr/> 787 | <hr/> 331 | <hr/> 1378 | <hr/> 9 | <hr/> 3 |

Total additions for the year2508
an increase of 379 titles over the previous year.

The Committee had at its disposal \$2890.00, appropriated by the Board of Managers and \$3900.32 being the income of the various trust funds.

The expenditures for the year were \$1601.91 for subscriptions to magazines and other periodical publications, \$768.75 for binding, \$2023.06 for books and \$107.61 for general expenses.

Donors:

Gifts of books, pamphlets and magazines in large quantities or of special value were given by Messrs. H. M. B. Bary, J. T. Butler, Charles E. Duryea, W. Copeland Furber, F. Lynwood Garrison, Henry Howson, Howard S. Levy, J. H. Mulligan, Lawrence T. Paul, Dr. Paul J. Sartain, Mrs. H. B. Hackett, Messrs. Harris and Richards, Mrs. E. H. Kanitz of New York City and the Shoemaker-Satterthwaite Bridge Company.

Dr. Edward G. Acheson presented the library with a year's subscription to *Forbes' Magazine* and Mr. Henry Howson, in addition to a gift of about 1000 volumes, presented a desk which has been placed in the reading room.

The contents of the library on September 30, 1920, were as follows:

Volumes, bound and unbound 74,668

| | |
|-----------------------|--------|
| Pamphlets | 16,597 |
| Maps and charts | 2,292 |
| Photographs | 1,349 |

Binding:

The following work was done by the binders during the year:

| | Volumes |
|---|-----------|
| Recent Periodicals | 224 |
| Recent unbound books | 4 |
| Old Volumes, bound, rebound and repaired..... | 16 |
| | <hr/> 244 |

Because of unusually high costs the number of volumes bound was less than one-half the number of the previous year. We look forward to a reduction in prices during the next few months and hope to be able to present a more satisfactory statement on the activities of this department of the library in our next report.

Periodicals:

The total number of periodical publications received by exchange, gift or purchase was 788.

Evening Hours:

The library was open until ten o'clock on 39 evenings during the winter months.

Respectfully submitted,

H. JERMAIN CREIGHTON,

Chairman.

PHILADELPHIA, January 12, 1921.

REPORT OF THE COMMITTEE ON MUSEUM.

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

To the President and Members of The Franklin Institute:

The following have been added to the Institute's collections during the period covered by this report:

Miniature of Dr. William H. Keating, one of the founders of the Institute. Painted by Mr. Hugh Bridport, first instructor in the Department of Free-hand Drawing of the Institute's school. Presented to the Institute by Mr. J. Percy Keating.

Silver Medal of The Franklin Institute exhibition of 1824, awarded to Mr. Joseph Swartz for specimens of domestic carpeting. Presented to the Institute by Mr. Arthur C. Chancellor, an alumnus of the Institute's School of Mechanic Arts.

Will of General George Washington printed from the records of the County Court of Fairfax, 1780, forty days after the General's death. Pamphlet of thirty-two pages. Presented by Mr. Arthur C. Chancellor, an alumnus of

the Institute's School of Mechanic Arts.

Air pump, formerly the property of Dr. Joseph Priestley, presented to the Institute by Mr. Coleman Sellers, Jr., and Mr. Horace Wells Sellers.

Ruling machine for engravers, camera obscura and camera used by Mr. John Sartain, artist, and Mr Samuel Sartain, former Treasurer of the Institute. Presented by Dr. Paul J. Sartain.

Daguerreotype of Matthias W. Baldwin. Presented by Mrs. I. W. Morris.

Respectfully submitted,

ALEX. E. OUTERBRIDGE, JR.,

Chairman.

PHILADELPHIA, January 12, 1921.

REPORT OF THE COMMITTEE ON MEETINGS.

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

To the President and Members of The Franklin Institute:

Eight stated meetings were held during the year ending September 30, 1920. These were held on the third Wednesday of each month at the hour of eight o'clock with the exception of that of May 19th, which was held at four o'clock in the afternoon. The following is a list of the speakers with the titles of their communications:

October 15, 1919: Captain S. W. Bryant, Acting Director, Naval Communication Service, "The U. S Naval Communication Service."

November 19, 1919: Rear Admiral J. A. Hoogewerff, U. S. Navy, Superintendent of the U. S. Naval Observatory, "The Relation of the U. S. Naval Observatory to the Navy and Shipping Interests of the Country."

December 17, 1919: Brigadier General R C. Marshall, Jr., U. S. A., Chief of the Construction Division, War Department, "The Construction Division of the Army."

January 21, 1920: Dr J. C. Hunsaker, Commander Construction Corps, U. S. N., "U. S. Naval Aircraft."

February 18, 1920: Dr. Irving Langmuir, Research Laboratory, General Electric Company, "The Structure of Atoms and its Bearing on Chemical Valance."

March 17, 1920: Mr. G. H. Clamer, "The Induction Electrical Furnace."

April 21, 1920: Rear Admiral David Watson Taylor, Chief Constructor U. S. N., Chief of Bureau of Construction and Repair, Navy Department, "The Design of War Vessels as Affected by the World War."

May 19, 1920: Presentation of the Franklin Medal to His Excellency Sir Auckland Geddes, British Ambassador, on behalf of His Britannic

Majesty's Government for Sir Charles A. Parsons and to Mr. Joen de Lagerberg, Secretary of the Swedish Legation, of Washington, D. C., on behalf of his Swedish Majesty's Government for Prof. Svante August Arrhenius. Mr. Charles Day read a paper prepared by Sir Charles A. Parsons entitled "Some Reminiscences of Early Days of Turbine Development," and Dr. Allerton S. Cushman, Director of the Institute of Industrial Research, Washington, D. C., read the paper on the "Problem of the World's Supply of Energy," prepared for the occasion by Professor Arrhenius.

All the communications were illustrated by lantern slides. Brigadier General Marshall used a great number of diagrams, plans, drawings and photographs which were loaned by Lt. Col. E. B. Morden, the Constructing Quartermaster of Philadelphia.

The meeting of October 15th was conducted jointly by the Institute and the Philadelphia Section of the American Institute of Electrical Engineers.

The meeting of January 21st was conducted jointly by the Institute and the Aero Club of Pennsylvania.

The meeting of February 18th was conducted jointly by the Institute and the Philadelphia Section of American Chemical Society.

The meeting of March 7th was conducted jointly by the Institute and the Philadelphia Section of the American Institute of Electrical Engineers.

It is gratifying to note that the attendance at these lectures is steadily increasing, from year to year, which seems to indicate a greater interest in the Meetings.

Respectfully submitted,

GELLERT ALLEMAN,

Chairman.

PHILADELPHIA, January 12, 1921.

REPORT OF THE COMMITTEE ON INSTRUCTION.

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

To the Board of Managers of The Franklin Institute:

The courses offered by The Franklin Institute School of Mechanic Arts in its ninety-sixth year, commencing in September, 1919, were substantially the same as those given the previous year, namely, Mechanical Drawing, Architectural Drawing and Design, Freehand Drawing and Water Color, Shop Arithmetic and Algebra, Plane Geometry and Trigonometry, Applied Mechanics and Strength of Materials, and Theoretical and Practical Naval Architecture.

The school opened on September 16, 1919, and during the year five hundred individual students were enrolled, an increase of 23 per cent. over that of the previous year. The school was taxed to its capacity and many applicants had to be denied admittance after the classrooms were filled. The largest classes formed during the year were those in First-Year Mathematics and

First-Year Mechanical Drawing. Marked interest was also shown in the course in Naval Architecture.

Unusual interest in their work was manifested by all of the students, and the high averages in attendance and class work indicate that the School of Mechanic Arts has completed one of its most successful years. For the first term ninety-four students had a perfect attendance record, and sixty-one had a perfect attendance record during the second term. In the regular school work, fifty-one students made an average of 90 per cent. or over during the first term, and forty-three an average of 90 per cent. or over during the second term.

The Faculty for the year was as follows:

Mr. Arthur J. Stretton, The Baldwin Locomotive Works, Mechanical Drawing.

Mr. I. P. Pedrick, William Sellers & Co., Inc., Mechanical Drawing.

Mr. G. W. H. Fawkes, of the University of Pennsylvania Faculty, Mechanical Drawing.

Mr. H. W. Howitz, The Baldwin Locomotive Works, Mechanical Drawing.

Mr. Clement Remington, Associated with Horace Trumbauer, Architect, Architectural Drawing.

Mr. John C. Bechtel, Germantown High School, Mathematics.

Mr. Howard S. Eitzel, Friends' Central High School, Mathematics.

Mr. K. E. DeRosay, of the University of Pennsylvania Faculty, Mathematics.

Mr. H. H. Fox, Norristown High School, Mathematics.

Mr. P. J. Brady, Philadelphia Electric Company, Mathematics.

Mr. Bartram A. Owen, of the University of Pennsylvania Faculty, Mechanics.

Mr. Joseph W. Thompson, New York Shipbuilding Company, Naval Architecture.

Mr. B. B. Wood, William Cramp & Sons' Ship and Engine Building Company, Naval Architecture.

Mr. Albert R. Ware, New York Shipbuilding Company, Naval Architecture.

Mr. H. Earl Barrett, William Cramp & Sons' Ship and Engine Building Company, Naval Architecture.

Mr. James G. Morgan, New York Shipbuilding Company, Naval Architecture.

During the year, students of the School, in company with members of the Alumni Association, visited the following places of engineering interest:

New York Shipbuilding Company, Camden, N. J.

The Broad Street Subway under City Hall, Philadelphia, Pa.

U. S. Army Supply Base, Greenwich Point, Philadelphia.

Hog Island Shipyard, Hog Island, Philadelphia.

In every case the attendance was good and much interest was shown by those present. Thanks are due to the managements represented for their courtesy and to the Alumni Association upon whose invitation the students made these visits.

On the evening of Tuesday, January 6, 1920, the Alumni Association held a meeting in the Hall of the Institute on which occasion Professor Earl J. Early, Head of the Art Department, Southern High School, Philadelphia, presented a paper on "Artistic Side Lights of the Forge." The subject was illustrated by lantern slides.

The graduating exercises were held in the Hall of the Institute on the evening of April 16, 1920. Dr. Walton Clark, President of the Institute, occupied the chair. The speaker of the evening was Hon. William A. Glasgow, Jr., LL.D. The Alumni Association was represented by Mr. Alfred Rigling, Secretary of the Association and Librarian of the Institute. Fifty-six students were graduated: seven in Mechanical Drawing, six in Architectural Drawing, one in Freehand Drawing, thirty-nine in Mathematics, and three in Naval Architecture.

The following scholarships were awarded:

Ten B. H. Bartol Scholarships,

Nine Isaac B. Thorn Scholarships.

The first award of the prize provided by the late John H. Siegler, Esq., Germantown, Philadelphia, in his will dated February 21, 1918, was made jointly to a student in Naval Architecture and a student in Freehand Drawing.

Following is the abstract of the will containing the conditions of the award:

"I give and bequeath unto The Franklin Institute the sum of one thousand dollars (\$1000), to be invested and kept invested, and the income arising therefrom and thereout to be given annually as a prize to the student deserving the highest commendation for earnest work and high standard of scholarship in regular attendance upon the sessions during the school year last past."

The student in the Department of Mathematics was awarded a prize donated by Mr. J. B. McCall, President of the Philadelphia Electric Company. A prize donated by Mr. Wilfred Lewis, President of the Tabor Manufacturing Company, was awarded to the student of greatest merit in the Department of Mechanics. Two students in the Department of Drawing were awarded prizes; to the student of greatest merit in Mechanical Drawing was awarded a prize donated by Mr. S. M. Vauclain, President of the Baldwin Locomotive Works, and to the student of greatest merit in Architectural Drawing was awarded a prize donated by Mr. Robert W. Lesley, a member of the Board of Managers. A set of drawing instruments, donated by the New York Shipbuilding Company, was awarded to the student of greatest merit in the Department of Naval Architecture. Six students received awards provided by the Alumni Association of The Franklin Institute School of Mechanic Arts and eighteen graduates, having a perfect attendance record, were awarded free membership for one year in the Association. Certificates of Honorable Mention were awarded to seventy students for excellent work during the year.

The graduates were invited to the annual smoker and dinner of the Alumni Association, held on the evening of Saturday, May 8, 1920. At the dinner 83 covers were laid and addresses were made by Mr. Coleman Sellers, Jr., representative of the Board of Managers, and by Hon. Alexander L

Rogers, Colonel in American Expeditionary Forces.

During the summer the School Calendar was published, 3000 copies of which and 1000 posters were distributed in such a way as seemed likely to reach the greatest number of possible students.

Respectfully submitted,

LAWRENCE T. PAUL,
Chairman.

PHILADELPHIA, January 12, 1921.

REPORT OF THE COMMITTEE ON ELECTION AND RESIGNATION OF MEMBERS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

To the Board of Managers of The Franklin Institute:

During the fiscal year ending September 30, 1920, sixty-seven new members were enrolled in all classes of membership; resignations were received and accepted from thirty-three members; and deaths of twenty-three members were recorded.

The detail as to elections, resignations, and deaths for the three years ending September 30, 1920, is as follows:

ELECTIONS:

| | 1917-18 | 1918-19 | 1919-20 |
|-----------------------------|---------|---------|---------|
| Resident Members | 15 | 21 | 32 |
| Non-Resident Members | 17 | 28 | 19 |
| Associate Members | 7 | 4 | 11 |
| Honorary Members | 0 | 10 | 2 |
| Corresponding Members | 0 | 0 | 3 |
| Life Members | 5 | 3 | 0 |
| Second-Class Stock | 1 | 0 | 0 |
| | — | — | — |
| | 45 | 66 | 67 |

RESIGNATIONS:

| | | | |
|----------------------------|----|----|----|
| Resident Members | 16 | 17 | 19 |
| Non-Resident Members | 13 | 10 | 14 |
| Associate Members | 1 | 0 | 0 |
| Second Class Stock | 0 | 0 | 0 |
| | — | — | — |
| | 30 | 27 | 33 |

DEATHS:

| | | | |
|----------------------------|---|----|---|
| Resident Members | 5 | 8 | 6 |
| Non-Resident Members | 7 | 12 | 8 |
| Life Members | 5 | 11 | 8 |
| Honorary Members | 0 | 1 | 1 |
| Associate Members | 0 | 2 | 0 |

| | 1917-18 | 1918-19 | 1919-20 |
|--------------------------|---------|---------|---------|
| Second Class Stock | 0 | 1 | 0 |
| | — | — | — |
| | 17 | 35 | 23 |

SUMMARY:

| | | | |
|---------------------------------------|----|----|----|
| Elections | 45 | 66 | 67 |
| Resignations | 30 | 27 | 33 |
| Dropped for non-payment of dues | 10 | 10 | 27 |
| Deaths | 17 | 35 | 23 |
| Net decrease in membership..... | | 16 | |

Members of the Institute by Classes, September 30, 1920:

| | |
|-----------------------------|------|
| Resident Members | 488 |
| Non-Resident Members | 589 |
| Life Members | 218 |
| Honorary Members | 24 |
| Associate Members | 32 |
| Second Class Stock | 25 |
| Corresponding Members | 4 |
| Total | 1380 |

It will be noted that a large part of the decrease in membership is due to the dropping of members for non-payment of dues. During the war the stringent enforcement of rules against the members for non-payment of dues was not pressed, but since the conclusion of hostilities and the return of normal business conditions action in this direction has been taken by the Secretary, with the result as shown in the report. It is hoped that during the coming year an increase of membership may be obtained, and the individual personal solicitation of our membership is requested to aid the Committee in this direction.

Respectfully submitted,

R. W. LESLEY,
Chairman.

PHILADELPHIA, January 12, 1921.

REPORT OF THE COMMITTEE ON STOCKS AND FINANCE.

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

To the Board of Managers of The Franklin Institute:

The Committee presents the following financial statement:

PROPERTY AND FUNDS.

| | | |
|--|-------------|--------------|
| Building and land, 13-17 South Seventh Street..... | \$60,000.00 | |
| Library | 100,000.00 | \$160,000.00 |

| | Principal | Unexpended Income | |
|---------------------------------------|----------------|----------------------|----------------|
| Fund held by Board of Trustees..... | \$642,001.51 | \$2,822.03 | |
| Funds held by Board of Managers..... | 146.39 | | |
| Franklin Institute Building Fund..... | 499,156.30 | | |
| Elliott Cresson Medal Fund..... | 3,000.00 | 598.86 | |
| Franklin Fund and Building Committee. | 14,384.50 | | |
| <hr/> | | | |
| Total Funds | \$1,146,690.70 | \$3,420.89 | 1,150,111.89 |
| <hr/> | | | |
| Grand Total | | | \$1,310,111.59 |

LIABILITIES.

| | |
|---|-------------|
| Certificates of Stock | \$29,440.00 |
| Mortgage on Institute Building (held by Trustees as investment for Fund) | 21,250.00 |
| Bills Payable | 31,000.00 |
| Vouchers Payable | 4,777.20 |
| Unearned Income | 6,467.20 |
| <hr/> | |
| Grand Total | \$92,934.40 |

INCOME AND EXPENSES APPLICABLE TO YEAR ENDED SEPTEMBER 30, 1920.

Income.

| | |
|---|-------------|
| Dues | \$10,695.00 |
| Initiation Fees | 110.00 |
| H. Belfield Memorial Fund | 268.82 |
| James H. Cresson Memorial Fund | 2,267.92 |
| General Endowment Fund | 19,480.03 |
| John H. Wahl Fund | 4,141.20 |
| Estate of John Turner | 139.18 |
| Estate of Robert Wright | 1,730.31 |
| Instruction: Drawing..... | \$2,080.00 |
| Mathematics | 1,826.00 |
| Mechanics | 323.00 |
| Naval Architecture | 937.50 |
| <hr/> | |
| Publications: Subscriptions and Sales | \$2,582.21 |
| Advertising | 2,493.47 |
| <hr/> | |
| | 5,075.68 |
| <hr/> | |
| | \$49,074.64 |

EXPENSES.

| | |
|---|------------|
| Building: Wages | \$1,727.70 |
| Repairs and Maintenance | 222.11 |
| Taxes, Water Rent and Insurance | 536.23 |
| Heat, Light and Power..... | 1,126.13 |
| Miscellaneous Supplies and Expense..... | 476.34 |
| <hr/> | |
| | 4,088.51 |

| | | |
|--|-------------|-------------|
| Instruction: Drawing | \$1,159.50 | |
| Mathematics | 1,072.50 | |
| Mechanics | 224.00 | |
| Naval Architecture | 840.00 | |
| Salaries and Annuities | 1,443.28 | |
| Miscellaneous Expense | 702.75 | 5,442.03 |
| <hr/> | | |
| Library: Salaries | \$6,754.43 | |
| Books and Periodicals | 1,601.91 | |
| Binding | 768.75 | |
| Miscellaneous Expense | 107.61 | 9,232.70 |
| <hr/> | | |
| Meetings | | 832.28 |
| Office and* General: Salaries | \$11,649.69 | |
| Office Expense | 1,219.28 | |
| General Expense | 1,246.75 | |
| Auditor and Treasurer | 848.49 | 14,964.21 |
| <hr/> | | |
| Publications: Printing | \$12,234.38 | |
| Reprints | 181.84 | |
| Illustrating | 2,341.74 | |
| Miscellaneous Expense | 426.16 | |
| Year Book | 728.97 | 15,913.09 |
| <hr/> | | |
| Science and Arts | | 3,907.67 |
| Sections | | 1,858.28 |
| University of Louvain Gift | | 296.57 |
| Interest and Discount | | 1,845.06 |
| Badges and Certificates | | 77.30 |
| Miscellaneous Income and Expense | | 275.46 |
| | | <hr/> |
| | | \$58,733.16 |
| <hr/> | | |
| Deficit | | \$9,658.52 |

The deficit as given in the foregoing is in operating expenses only, because during the year the increase in assets over liabilities has been \$51,947.54.

Respectfully submitted,

WALTON FORSTALL,
Chairman.

PHILADELPHIA, January 12, 1921.

REPORT OF THE COMMITTEE ON PUBLICATIONS.

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

To the Board of Managers of The Franklin Institute:

The two principal publications of the Institute, the monthly JOURNAL of its proceedings and the Year Book, have been published as usual. The JOURNAL is supplied to the membership of the Institute and copies are exchanged with similar publications of other institutions and with scientific and technical Journals. They are also kept on file in Scientific Libraries. To meet this demand 2625 copies have been printed each month throughout the year. The Year Book is also supplied to the membership and distributed to the leading scientific societies throughout the world, this requiring the publication of 2000 copies.

Many of the lectures delivered in The Franklin Institute course of Lectures were printed in the JOURNAL as well as special articles contributed by leading scientists and technologists with the purpose of making the JOURNAL a record of original research and a report of progress in scientific fields.

The publication of "The Physics of the Air," by Dr. W. J. Humphreys, Professor of Meteorological Physics, U. S. Weather Bureau, was nearing completion during the period covered by this report and orders were received for several hundred copies.

The notes from the various scientific Bureaus and Research Laboratories were continued throughout the year and contained the most recent accounts of the activities of these various institutions.

The material published under the heading of Current Topics was prepared by several members of the Institute.

The high costs continued during the period of this report, and there is still no prospect of any change. The publication expenses for the year are as follows:

| | |
|-----------------------------|-------------|
| Printing | \$12,234.38 |
| Reprints | 181.84 |
| Illustrations | 2,341.74 |
| Year Book | 728.97 |
| Miscellaneous Expense | 426.16 |

Total \$15,913.09

A complete set of the JOURNAL, with the various index volumes, was contributed to the University of Louvain for the restoration of its library.

Acknowledgment is due to our Associate Editors for valuable co-operation rendered during the year.

Respectfully submitted,

GEORGE D. ROSENGARTEN,

Chairman.

PHILADELPHIA, PA., JANUARY 12, 1921.

REPORT OF THE COMMITTEE ON SECTIONAL ARRANGEMENTS.

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

To the Board of Managers of The Franklin Institute:

During the year ending September 30, 1920, nineteen meetings were conducted by the several sections of the Institute, and five meetings were held during the season with other local societies, as follows:

Total Number of Meetings Held: 19.

Section of Physics and Chemistry: Eleven meetings.

October 23, 1919.

"Flash and Sound Ranging Apparatus for the Location of Guns." Augustus Trowbridge, Ph.D., D.S.M., D.S.O., Chev. L. H., Professor of Physics, Princeton University. Illustrated.

November 6, 1919.

"American Dye Industries Present and Future." Dr. Bernhard C. Hesse, New York, N. Y. Illustrated.

November 13, 1919.

"Nutrition and Physical Efficiency." Dr. E. V. McCollum of the School of Hygiene and Public Health, The Johns Hopkins University. Illustrated.

December 11, 1919.

"Motor Fuels." Dr. E. W. Dean, Petroleum Chemist, Bureau of Mines. Illustrated.

January 8, 1920.

"The Physics of Flight." Dr. David L. Webster, Assistant Professor of Physics, Massachusetts Institute of Technology, Formerly Captain Aviation Section Signal Officers' Reserve Corps. Illustrated.

January 15, 1920.

"The Audion, Its Action and Some Recent Application." Dr. Lee de Forest of New York City. Illustrated by lantern slides and apparatus.

February 5, 1920.

"Helium." Dr. R. B. Moore, Chief Chemist, Bureau of Mines. Illustrated by lantern slides and experiments.

March 4, 1920.

"The Chemistry of the Earth's Crust." Dr. Henry S. Washington, Petrologist, Geophysical Laboratory, Carnegie Institution of Washington. Illustrated.

March 11, 1920.

"Photographing Sound Waves from Large Guns and Projectiles." Dr. Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio. Illustrated by lantern slides and experiments.

March 25, 1920.

"Optical Glass and Its Future as an American Industry." Dr. Arthur L. Day, Director, Geophysical Laboratory, Carnegie Institution of Washington. Illustrated by lantern slides and specimens.

April 1, 1920.

"Aeronautical Instruments." Dr. Charles E. Mendenhall, Professor of Physics, University of Wisconsin. Illustrated.

ELECTRICAL SECTION—TWO MEETINGS.

October 30, 1919.

"Wireless Telephony." Mr. N. H. Slaughter, Engineering Department, Western Electric Company, New York City, formerly Lt. Col. in the Signal Corps, U. S. A. Illustrated by lantern slides and experimental demonstrations.

April 8, 1920.

"Electric Welding as Applied to Shipbuilding." Comfort A. Adams, S.B., E.E., Dean of the Harvard Engineering School. Illustrated.

MINING AND METALLURGICAL SECTION—THREE MEETINGS.

December 4, 1919.

"Destruction of French Coal Mines and Their Rehabilitation." Mr. George S. Rice, Chief Mining Engineer, Bureau of Mines. Illustrated.

January 29, 1920.

"Fundamental Principles to be Considered in the Heat Treatment of Steel." Albert Sauveur, Professor of Metallurgy and Metallography, Harvard University. Illustrated by lantern slides and charts.

April 15, 1920.

"Recent Progress in the Metallurgy of Non-Ferrous Metals." Dr. D. A. Lyon, Bureau of Mines. Illustrated.

MECHANICAL AND ENGINEERING SECTION—TWO MEETINGS.

October 2, 1919.

"The American Air Service at the Front." Brigadier General William Mitchell, Division of Military Aeronautics, War Department. Illustrated.

February 26, 1920.

"Artillery of the American Expeditionary Forces." Major General C. C. Williams, Chief of Ordnance, U. S. A., War Department. Illustrated.

SECTION OF PHOTOGRAPHY AND MICROSCOPY—ONE MEETING.

October 9, 1919.

"Photography from the Airplane." Dr. Herbert E. Ives, formerly Major, Aviation Section Signal Reserve Corps. Illustrated.

Joint meetings were held during the season with other local societies as follows:

Philadelphia Section American Chemical Society, November 6th, November 13th, February 5th, March 25th and April 15th.

Physics Club, January 8th, January 15th, March 11th and April 1st.

Philadelphia Section American Institute of Electrical Engineers, October 30th, January 15th and April 8th.

Aero Club of Pennsylvania, October 2nd, October 9th and January 8th.

Philadelphia Chapter American Steel Treathers' Society, January 29th.

A number of the lectures have since appeared in the JOURNAL of the Institute. Most of the lectures were profusely illustrated by lantern slides and experiments.

Respectfully submitted,

HARRY F. KELLER.

Chairman.

PHILADELPHIA, PA., January 12, 1921.

REPORT OF THE COMMITTEE ON ENDOWMENT.

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

To the Board of Managers of The Franklin Institute:

The funds of the Institute were increased during the year as follows:

| Fund | Increase | Reason for Increase |
|---|------------|---|
| General Endowment Fund | \$7,322.44 | Thos. Skelton Harrison Legacy \$6,500.00 Life Membership 75.00 Excess of sale value of securities over book value.. 747.44 |
| John H. Siegler Fund.... | 4.65 | Transfer of interest to principal. |
| J. P. Wetherill Memorial Research Fund | 491.67 | Transfer of interest to principal. |
| Trustees' Building Fund (new) | *19,349.07 | Lewis S. Ware Building Fund Legacy of \$19,000. |
| Lewis S. Ware Library Fund | 19,012.50 | Legacy from Lewis S. Ware. |

| Fund | Increase | Reason for Increase |
|--|--------------------|---------------------------------------|
| New Building Endowment Fund | 5.15 | Transfer of interest to principal. |
| Franklin Institute Building Fund | 11,889.91 | Increase through interest and income. |
| | <u>\$58,075.39</u> | |

* This fund is the merging, as of September 30, 1920, of the Lewis S. Ware Building Fund, the Elizabeth M. Graff Fund, and the Building Money Fund.

On November 1, 1919, the Orphans' Court approved the final account of the Executors of the Estate of Lewis S. Ware, awarding to the Institute an account of the bequest for the upkeep of the Ware Sugar Library \$18,788.42 and to the building fund of the Institute \$18,786.74.

Under date of September 15, 1920, the Orphans' Court approved the schedule of distribution presented by the Executors of the Estate of Harriet Blanchard, awarding the Institute the sum of \$50,000 plus a further sum of \$5,199.87.

Your Committee was chiefly concerned during the year with negotiations in connection with the Bequest of Henry W. Bartol and is happy to report that compromises were reached with the contestants to the will which are regarded as favorable to the Institute. All opposition is withdrawn and the necessary measures are being taken for the final settlement of the estate. On July 13, 1920, the Orphans' Court approved the account of the administrator's pendent lite and authorized the agreement which had been reached with the representatives of the widow. The audit, of the estate, as of that date was:

| | |
|-----------------|-----------------------|
| Principal | \$2,297,276.14 |
| Income | 87,206.14 |
| Total | <u>\$2,384,482.28</u> |

Respectfully submitted,

COLEMAN SELLERS, JR.,
Chairman.

PHILADELPHIA, January 12, 1921.

REPORT OF THE COMMITTEE ON SCIENCE AND THE ARTS.

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

To the President and Members of The Franklin Institute:

Established in 1834, the Committee in Science and the Arts has completed its eighty-sixth year of continuous service to the Institute. During this year the Committee has investigated and disposed of twenty-two cases and has seventeen cases pending.

The Standing Sub-Committee on The Franklin Medal and the Standing Sub-Committee on Literature met as required during the year and upon their

recommendation the awards shown in the appended statement were made. The Sub-Committee on New Subjects and Preliminary Examination met each month on the afternoon of the day on which the Stated Meeting of the Committee on Science and the Arts was held. Its work was well done.

Fifty-three cases were considered by this examining Sub-Committee and of these twenty-seven were recommended for examination. Fifteen applications were received during the year from inventors, and Sub-Committees of investigation appointed.

In accordance with the precedent, the recipients of awards were invited to attend the Stated Meetings of the Institute to receive these recognitions from the President. Many accepted the invitation and others sent letters expressing their appreciation of the awards.

The May, 1920, Meeting of the Institute, at which the sixth series of Franklin Medals was awarded, brought together a gathering of distinguished men. Sir Auckland Geddes, British Ambassador to the United States, received the medal for Sir Charles Algernon Parsons, awarded in recognition of his work in the development of the steam turbine. Mr. Joen de Lagerberg, Secretary of the Swedish Legation, received the medal for Professor Svante August Arrhenius, awarded in recognition of his notable contributions to the theory of physical science.

In accepting the medal for Sir Charles Parsons, Ambassador Geddes spoke of his high appreciation of the award to his countryman and emphasized the value of "such gracious acts of international courtesy." Secretary de Lagerberg, after expressing similar appreciation, noted the regrets of Mr. Ekengren, the Swedish Minister, that he was not able to receive the medal in person for Professor Arrhenius. During the ceremonies attendant upon the presentation, a paper on "Some Reminiscences of Early Days of Turbine Development," prepared by Sir Charles Parsons, was then read by Mr. Charles Day, Vice-President of the Institute. A paper on "The Problem of the World's Supply of Energy," by Professor Arrhenius, was read by Doctor Allerton S. Cushman, a member of the Institute and Associate Editor of the JOURNAL. Notices of these awards were furnished to the Philadelphia daily papers and to technical journals.

It is also worthy of note, that at the September 1st Meeting a special Committee reported on the Practice of Recommending Awards. This important report has been printed for the use of the Committee on Science and the Arts and constitutes a decided step toward the standardization of the Committee's work along the line of definitely determining the requirements for the several awards.

The attendance at the Stated Meetings of the Committee on Science and the Arts has been satisfactory as well as the attendance at the dinners preceding these meetings. It has been found that these dinners afford an opportunity for the members to meet in an informal way and to discuss questions that pertain to the work.

The personnel of the Committee numbers fifty-eight members.

A detailed statement of the work of the Committee during the past year follows.

Respectfully submitted,

C. PENROSE,
Chairman.

PHILADELPHIA, January 12, 1921.

APPENDIX.

STATEMENT OF THE COMMITTEE'S OPERATION FOR THE YEAR ENDING SEPTEMBER 30, 1920.

| | |
|-------------------------------------|----|
| Cases pending October 1, 1919 | 19 |
| Applications during the year | 16 |
| Special Reports | 4 |
| | — |
| | 39 |
| Disposed of during the year | 22 |
| Leaving pending | 17 |

AWARDS MADE.

| | |
|-----------------------------------|----|
| Franklin Medal Awards | 2 |
| Howard N. Potts Awards | 2 |
| Edward Longstreth Awards | 6 |
| Certificate of Merit Awards | 4 |
| | — |
| | 14 |

AWARDS MADE DURING THE YEAR.

THE FRANKLIN MEDAL.

Sir Charles Algernon Parsons, of Newcastle-on-Tyne, England, "in recognition of his epoch-making labors on the construction and development of steam-turbines which have revolutionized the art of steam engineering, particularly in regard to the propulsion of mercantile and naval vessels, and the driving of electrical generators."

Professor Svante August Arrhenius, of Stockholm, Sweden, "in recognition of his contributions to the theory of physical science which have found unprecedently extended and fruitful application in the experimental study of chemical, physical, biological and cosmic phenomena, as well as in industrial chemistry."

THE HOWARD N. POTTS MEDAL.

Clarence P. Landreth, of Philadelphia, Pa., for his inventions and improvements embodied in the Landreth Electrolytic Sewage Process.

Wendell Addison Barker, of Elkhart, Ind., for his Wrenchless Chuck.

THE EDWARD LONGSTRETH MEDAL.

M. Lukiesh, of the Nela Research Laboratory, Nela Park, Cleveland, Ohio, for his paper, entitled "The Visibility of Airplanes," in the JOURNAL.

William Wallace Kemp, of Baltimore, Md., jointly with William H. Van Horn, for his inventions embodied in the Kemp Gas System.

William H. Van Horn, of Baltimore, Md., jointly with William Wallace Kemp, for his inventions embodied in the Kemp Gas System.

Morris E. Leeds, of Philadelphia, Pa., for his inventions and improvements embodied in Indicating and Recording Devices.

John Walter Ledoux, of Philadelphia, for his Simplex Fluid Meter.

H. Clyde Snook, of New York, for his inventions embodied in the Snook X-ray System.

THE CERTIFICATE OF MERIT.

David Landau, of New York, for the paper prepared in conjunction with Percy H. Parr, entitled "A New Theory of Plate Springs," in the JOURNAL.

Percy H. Parr, of New York, for the paper prepared in conjunction with David Landau, entitled "A New Theory of Plate Springs," in the JOURNAL.

Charles W. Hays, of Michigan City, Ind., jointly with Joseph W. Hays, for his inventions embodied in the Hays CO₂ and Draft Recorder.

Joseph W. Hays, of Michigan City, Ind., jointly with Charles W. Hays, for his inventions embodied in the Hays CO₂ and Draft Recorder.

ELLIOTT CRESSON MEDAL RECOMMENDATION.

(Award Pending.)

Byron E. Eldred, of New York, N. Y., for the Low Expansion Leading-in Wire for Incandescent Electric Lamps.

HOWARD N. POTTS MEDAL RECOMMENDATION.

(Award Pending.)

Edward Payson Bullard, Jr., of Bridgeport, Conn., for the "Automatic Machine Tool."

THE FRANKLIN INSTITUTE AWARDS

OCTOBER, 1920, TO JUNE, 1921.

THE FRANKLIN MEDAL.

Professor Charles Fabry, of Paris, France, "in recognition of his numerous and highly important contributions in the field of physical science, particularly the solution of optical and spectroscopical problems of fundamental importance."

Mr. Frank Julian Sprague, of New York, N. Y., "In recognition of his many and fundamentally important inventions and achievements in the field of electrical engineering, notably his contributions to the development of the electric motor and its application to industrial purposes, and in the art of electric traction, signally important in forming the basis of world-wide industries and promoting human welfare."

THE ELLIOTT CRESSON MEDAL.

Byron E. Eldred, of New York, N. Y., for the Low Expansion Leading-in Wire for Incandescent Electric Lamps.

W. L. R. Emmet, of Schenectady, New York, for his work on the Electric Propulsion of Ships and Prime Movers.

THE HOWARD N. POTTS MEDAL.

Edward Payson Bullard, Jr., of Bridgeport, Connecticut, for the "Automatic Machine Tool."

Elmer V McCollum, of Baltimore, Maryland, for his paper entitled "Nutrition and Physical Efficiency," in the JOURNAL.

Alfred O. Tate, of Cranston, Rhode Island, for his Electrolytic Process of Waterproofing Textile Fabrics.

THE EDWARD LONGSTRETH MEDAL.

Leason H. Adams, of Washington, D. C., for the paper prepared in conjunction with Erskine D. Williamson, entitled "The Annealing of Glass," in the JOURNAL.

Professor J. Bergonie, of Bordeaux, France, for his Application of Electro-Magnetic Mean and Apparatus to the Location of metallic fragments imbedded in Muscular Tissues.

W. Barton Eddison, of Ardsley-on-Hudson, New York, for his inventions and improvements embodied in the Surface Combustion Burner.

B. H. Hite, of Morgantown, West Virginia, for his Method of Sterilization by High Pressure.

Goddank L. Kothny, of Philadelphia, Pennsylvania, jointly with Robert

Suczek, for his inventions embodied in the Radojet Air Pump.

Jacob M. Spitzglass, of Chicago, Illinois, for his inventions embodied in the Republic Flow Meter.

Robert Suczek, of Philadelphia, Pa., jointly with Goddank L. Kothny, for his inventions embodied in the Radojet Air Pump.

Erskine D. Williamson, of Washington, D. C., for the paper prepared in conjunction with Leason H. Adams, entitled "The Annealing of Glass," in the JOURNAL.

THE CERTIFICATE OF MERIT.

Eugene C. Bingham, of Easton, Pa., for the inventions and improvements embodied in the Variable Pressure Viscometer.

Joseph S. Hepburn, of Philadelphia, Pennsylvania, for the paper prepared in conjunction with E. Quintard St. John and Frank Morton Jones, entitled "The Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ," in the JOURNAL.

Frank Morton Jones, of Wilmington, Delaware, for the paper prepared in conjunction with Joseph S. Hepburn and E. Quintard St. John, entitled "The Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ," in the JOURNAL.

E. Quintard St. John, of Philadelphia, Pennsylvania, for the paper prepared in conjunction with Joseph S. Hepburn and Frank Morton Jones, entitled "The Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ," in the JOURNAL.

FRANKLIN MEDAL AWARDS

1915-1921.

ARRHENIUS, SVANTE AUGUST.

"In recognition of his notable contributions to the theory of physical science which have found unprecedentedly extended and fruitful application in the experimental study of chemical, physical, biological and cosmic phenomena, as well as in industrial chemistry."

1920.

CARTY, JOHN J.

"In recognition of his long-continued activities in the telephone service, his important and varied contributions to the telephone art, his work in the establishment of the principles of telephone engineering, and his signal success in directing the efforts of a large staff of engineers and scientists to the accomplishment of the telephonic transmission of speech over vast distances."

1916.

DEWAR, SIR JAMES.

"In recognition of his numerous and most important contributions to our knowledge of physical and chemical phenomena, and his great skill and inventive genius in attacking and solving chemical and physical problems of the first magnitude."

1919.

EDISON, THOMAS ALVA.

"In recognition of the value of numerous basic inventions and discoveries forming the foundation of world-wide industries, signally contributing to the well-being, comfort and pleasure of the human race."

1915.

FABRY, CHARLES.

"In recognition of his numerous and highly important contributions in the field of physical science, particularly the solution of optical and spectroscopical problems of fundamental importance." 1921.

LORENTZ, HENDRIK ANTOON.

"In recognition of his researches which have so largely contributed to laying on a new foundation our knowledge of the nature of light and in developing our ideas concerning the ultimate construction of matter."

1917.

MARCONI, GUGLIELMO.

"In recognition of his brilliant inception and successful development of the application of magneto-electric waves to the transmission of signals and telegrams without the use of metallic conductors."

1918.

MENDENHALL, THOMAS CORWIN.

"In recognition of his fruitful and indefatigable labors in physical research, particularly his contributions to our knowledge of physical constants and electrical standards."

1918.

ONNES, HEIKE KAMERLINGH.

"In recognition of his long-continued and indefatigable labors in low-temperature research, which have enriched physical science, not only with a great number of new methods and ingenious devices, but also with achievements and discoveries of the first magnitude."

1915.

PARSONS, SIR CHARLES ALGERNON.

"In recognition of his epoch-making success in the development of the steam turbine, which has revolutionized the art of steam engineering, particularly in regard to the propulsion of mercantile and naval vessels and the driving of electrical generators."

1920.

RICHARDS, THEODORE WILLIAM.

"In recognition of his numerous and important contributions to inorganic, physical and theoretical chemistry, and particularly his classical series of redeterminations of the atomic weights of the more important chemical elements."

1916.

SPRAGUE, FRANK J.

"In recognition of his many and fundamentally important inventions and achievements in the field of electrical engineering, notably his contributions to the development of the electric motor and its application to industrial purposes, and in the art of electric traction, signally important in forming the basis of world-wide industries and promoting human welfare."

1921.

SQUIER, GEORGE OWEN.

"In recognition of his valuable contributions to physical science, his important and varied inventions in multiplex telephony and telegraphy and in ocean cabling and his eminent success in organizing and directing the air and signal services of the U. S. Army in the World War."

1919.

TAYLOR, DAVID WATSON.

"In recognition of his fundamental contributions to the theory of ship resistance and screw propulsion and of his signal success in the application of correct theory to the practical design of varied type of war vessels in the United States Navy."

1917.

March 11, 1920.

"Photographing Sound Waves from Large Guns and Projectiles." Dr. Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio. Illustrated by lantern slides and experiments.

March 25, 1920.

"Optical Glass and Its Future as an American Industry." Dr. Arthur L. Day, Director, Geophysical Laboratory, Carnegie Institution of Washington. Illustrated by lantern slides and specimens.

April 1, 1920.

"Aeronautical Instruments." Dr. Charles E. Mendenhall, Professor of Physics, University of Wisconsin. Illustrated.

ELECTRICAL SECTION—TWO MEETINGS.

October 30, 1919.

"Wireless Telephony." Mr. N. H. Slaughter, Engineering Department, Western Electric Company, New York City, formerly Lt. Col. in the Signal Corps, U. S. A. Illustrated by lantern slides and experimental demonstrations.

April 8, 1920.

"Electric Welding as Applied to Shipbuilding." Comfort A. Adams, S.B., E.E., Dean of the Harvard Engineering School. Illustrated.

MINING AND METALLURGICAL SECTION—THREE MEETINGS.

December 4, 1919.

"Destruction of French Coal Mines and Their Rehabilitation." Mr. George S. Rice, Chief Mining Engineer, Bureau of Mines. Illustrated.

January 29, 1920.

"Fundamental Principles to be Considered in the Heat Treatment of Steel." Albert Sauveur, Professor of Metallurgy and Metallography, Harvard University. Illustrated by lantern slides and charts.

April 15, 1920.

"Recent Progress in the Metallurgy of Non-Ferrous Metals." Dr. D. A. Lyon, Bureau of Mines. Illustrated.

MECHANICAL AND ENGINEERING SECTION—TWO MEETINGS.

October 2, 1919.

"The American Air Service at the Front." Brigadier General William Mitchell, Division of Military Aeronautics, War Department. Illustrated.

February 26, 1920.

"Artillery of the American Expeditionary Forces." Major General C. C. Williams, Chief of Ordnance, U. S. A., War Department. Illustrated.

SECTION OF PHOTOGRAPHY AND MICROSCOPY—ONE MEETING.

October 9, 1919.

"Photography from the Airplane." Dr. Herbert E. Ives, formerly Major, Aviation Section Signal Reserve Corps. Illustrated.

Joint meetings were held during the season with other local societies as follows:

Philadelphia Section American Chemical Society, November 6th, November 13th, February 5th, March 25th and April 15th.

Physics Club, January 8th, January 15th, March 11th and April 1st.

Philadelphia Section American Institute of Electrical Engineers, October 30th, January 15th and April 8th.

Aero Club of Pennsylvania, October 2nd, October 9th and January 8th.

Philadelphia Chapter American Steel Treathers' Society, January 29th.

A number of the lectures have since appeared in the JOURNAL of the Institute. Most of the lectures were profusely illustrated by lantern slides and experiments.

Respectfully submitted,

HARRY F. KELLER.

Chairman.

PHILADELPHIA, PA., January 12, 1921.

REPORT OF THE COMMITTEE ON ENDOWMENT.

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

To the Board of Managers of The Franklin Institute:

The funds of the Institute were increased during the year as follows:

| Fund | Increase | Reason for Increase |
|---|------------|---|
| General Endowment Fund | \$7,322.44 | Thos. Skelton Harrison Legacy \$6,500.00 Life Membership 75.00 Excess of sale value of securities over book value.. 747.44 |
| John H. Siegler Fund.... | 4.65 | Transfer of interest to principal. |
| J. P. Wetherill Memorial Research Fund | 491.67 | Transfer of interest to principal. |
| Trustees' Building Fund (new) | *19,349.07 | Lewis S. Ware Building Fund Legacy of \$19,000. |
| Lewis S. Ware Library Fund | 19,012.50 | Legacy from Lewis S. Ware. |

| Fund | Increase | Reason for Increase |
|--|--------------------|---------------------------------------|
| New Building Endowment Fund | 5.15 | Transfer of interest to principal. |
| Franklin Institute Building Fund | 11,889.91 | Increase through interest and income. |
| | <u>\$58,075.39</u> | |

* This fund is the merging, as of September 30, 1920, of the Lewis S. Ware Building Fund, the Elizabeth M. Graff Fund, and the Building Money Fund.

On November 1, 1919, the Orphans' Court approved the final account of the Executors of the Estate of Lewis S. Ware, awarding to the Institute on account of the bequest for the upkeep of the Ware Sugar Library \$18,788.42 and to the building fund of the Institute \$18,786.74.

Under date of September 15, 1920, the Orphans' Court approved the schedule of distribution presented by the Executors of the Estate of Harriet Blanchard, awarding the Institute the sum of \$50,000 plus a further sum of \$5,199.87.

Your Committee was chiefly concerned during the year with negotiations in connection with the Bequest of Henry W. Bartol and is happy to report that compromises were reached with the contestants to the will which are regarded as favorable to the Institute. All opposition is withdrawn and the necessary measures are being taken for the final settlement of the estate. On July 13, 1920, the Ophans' Court approved the account of the administrator's pendent lite and authorized the agreement which had been reached with the representatives of the widow. The audit, of the estate, as of that date was:

| | |
|-----------------|-----------------------|
| Principal | \$2,267,276.14 |
| Income | 87,206.14 |
| Total | <u>\$2,354,482.28</u> |

Respectfully submitted,

COLEMAN SELLERS, JR.,
Chairman.

PHILADELPHIA, January 12, 1921.

REPORT OF THE COMMITTEE ON SCIENCE AND THE ARTS.

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1920.

To the President and Members of The Franklin Institute:

Established in 1834, the Committee in Science and the Arts has completed its eighty-sixth year of continuous service to the Institute. During this year the Committee has investigated and disposed of twenty-two cases and has seventeen cases pending.

The Standing Sub-Committee on The Franklin Medal and the Standing Sub-Committee on Literature met as required during the year and upon their

recommendation the awards shown in the appended statement were made. The Sub-Committee on New Subjects and Preliminary Examination met each month on the afternoon of the day on which the Stated Meeting of the Committee on Science and the Arts was held. Its work was well done.

Fifty-three cases were considered by this examining Sub-Committee and of these twenty-seven were recommended for examination. Fifteen applications were received during the year from inventors, and Sub-Committees of investigation appointed.

In accordance with the precedent, the recipients of awards were invited to attend the Stated Meetings of the Institute to receive these recognitions from the President. Many accepted the invitation and others sent letters expressing their appreciation of the awards.

The May, 1920, Meeting of the Institute, at which the sixth series of Franklin Medals was awarded, brought together a gathering of distinguished men. Sir Auckland Geddes, British Ambassador to the United States, received the medal for Sir Charles Algernon Parsons, awarded in recognition of his work in the development of the steam turbine. Mr. Joen de Lagerberg, Secretary of the Swedish Legation, received the medal for Professor Svante August Arrhenius, awarded in recognition of his notable contributions to the theory of physical science.

In accepting the medal for Sir Charles Parsons, Ambassador Geddes spoke of his high appreciation of the award to his countryman and emphasized the value of "such gracious acts of international courtesy." Secretary de Lagerberg, after expressing similar appreciation, noted the regrets of Mr. Ekengren, the Swedish Minister, that he was not able to receive the medal in person for Professor Arrhenius. During the ceremonies attendant upon the presentation, a paper on "Some Reminiscences of Early Days of Turbine Development," prepared by Sir Charles Parsons, was then read by Mr. Charles Day, Vice-President of the Institute. A paper on "The Problem of the World's Supply of Energy," by Professor Arrhenius, was read by Doctor Allerton S. Cushman, a member of the Institute and Associate Editor of the JOURNAL. Notices of these awards were furnished to the Philadelphia daily papers and to technical journals.

It is also worthy of note, that at the September 1st Meeting a special Committee reported on the Practice of Recommending Awards. This important report has been printed for the use of the Committee on Science and the Arts and constitutes a decided step toward the standardization of the Committee's work along the line of definitely determining the requirements for the several awards.

The attendance at the Stated Meetings of the Committee on Science and the Arts has been satisfactory as well as the attendance at the dinners preceding these meetings. It has been found that these dinners afford an opportunity for the members to meet in an informal way and to discuss questions that pertain to the work.

The personnel of the Committee numbers fifty-eight members.

A detailed statement of the work of the Committee during the past year follows.

Respectfully submitted,

C. PENROSE,
Chairman.

PHILADELPHIA, January 12, 1921.

APPENDIX.

STATEMENT OF THE COMMITTEE'S OPERATION

FOR THE

YEAR ENDING SEPTEMBER 30, 1920.

| | |
|-------------------------------------|----|
| Cases pending October 1, 1919 | 19 |
| Applications during the year | 16 |
| Special Reports | 4 |
| | — |
| | 39 |
| Disposed of during the year | 22 |
| Leaving pending | 17 |

AWARDS MADE.

| | |
|-----------------------------------|----|
| Franklin Medal Awards | 2 |
| Howard N. Potts Awards | 2 |
| Edward Longstreth Awards | 6 |
| Certificate of Merit Awards | 4 |
| | — |
| | 14 |

AWARDS MADE DURING THE YEAR.

THE FRANKLIN MEDAL.

Sir Charles Algernon Parsons, of Newcastle-on-Tyne, England, "in recognition of his epoch-making labors on the construction and development of steam-turbines which have revolutionized the art of steam engineering, particularly in regard to the propulsion of mercantile and naval vessels, and the driving of electrical generators."

Professor Svante August Arrhenius, of Stockholm, Sweden, "in recognition of his contributions to the theory of physical science which have found unprecedently extended and fruitful application in the experimental study of chemical, physical, biological and cosmic phenomena, as well as in industrial chemistry."

THE HOWARD N. POTTS MEDAL.

Clarence P. Landreth, of Philadelphia, Pa., for his inventions and improvements embodied in the Landreth Electrolytic Sewage Process.

Wendell Addison Barker, of Elkhart, Ind., for his Wrenchless Chuck.

THE EDWARD LONGSTRETH MEDAL.

M. Lukiesh, of the Nela Research Laboratory, Nela Park, Cleveland, Ohio, for his paper, entitled "The Visibility of Airplanes," in the JOURNAL.

William Wallace Kemp, of Baltimore, Md., jointly with William H. Van Horn, for his inventions embodied in the Kemp Gas System.

William H. Van Horn, of Baltimore, Md., jointly with William Wallace Kemp, for his inventions embodied in the Kemp Gas System.

Morris E. Leeds, of Philadelphia, Pa., for his inventions and improvements embodied in Indicating and Recording Devices.

John Walter Ledoux, of Philadelphia, for his Simplex Fluid Meter.

H. Clyde Snook, of New York, for his inventions embodied in the Snook X-ray System.

THE CERTIFICATE OF MERIT.

David Landau, of New York, for the paper prepared in conjunction with Percy H. Parr, entitled "A New Theory of Plate Springs," in the JOURNAL.

Percy H. Parr, of New York, for the paper prepared in conjunction with David Landau, entitled "A New Theory of Plate Springs," in the JOURNAL.

Charles W. Hays, of Michigan City, Ind., jointly with Joseph W. Hays, for his inventions embodied in the Hays CO₂ and Draft Recorder.

Joseph W. Hays, of Michigan City, Ind., jointly with Charles W. Hays, for his inventions embodied in the Hays CO₂ and Draft Recorder.

ELLIOTT CRESSON MEDAL RECOMMENDATION.

(Award Pending.)

Byron E. Eldred, of New York, N. Y., for the Low Expansion Leading-in Wire for Incandescent Electric Lamps.

HOWARD N. POTTS MEDAL RECOMMENDATION.

(Award Pending.)

Edward Payson Bullard, Jr., of Bridgeport, Conn., for the "Automatic Machine Tool."

THE FRANKLIN INSTITUTE AWARDS

OCTOBER, 1920, TO JUNE, 1921.

THE FRANKLIN MEDAL.

Professor Charles Fabry, of Paris, France, "in recognition of his numerous and highly important contributions in the field of physical science, particularly the solution of optical and spectroscopical problems of fundamental importance."

Mr. Frank Julian Sprague, of New York, N. Y., "In recognition of his many and fundamentally important inventions and achievements in the field of electrical engineering, notably his contributions to the development of the electric motor and its application to industrial purposes, and in the art of electric traction, signally important in forming the basis of world-wide industries and promoting human welfare."

THE ELLIOTT CRESSON MEDAL.

Byron E. Eldred, of New York, N. Y., for the Low Expansion Leading-in Wire for Incandescent Electric Lamps.

W. L. R. Emmet, of Schenectady, New York, for his work on the Electric Propulsion of Ships and Prime Movers.

THE HOWARD N. POTTS MEDAL.

Edward Payson Bullard, Jr., of Bridgeport, Connecticut, for the "Automatic Machine Tool."

Elmer V McCollum, of Baltimore, Maryland, for his paper entitled "Nutrition and Physical Efficiency," in the JOURNAL.

Alfred O. Tate, of Cranston, Rhode Island, for his Electrolytic Process of Waterproofing Textile Fabrics.

THE EDWARD LONGSTRETH MEDAL.

Leason H. Adams, of Washington, D. C., for the paper prepared in conjunction with Erskine D. Williamson, entitled "The Annealing of Glass," in the JOURNAL.

Professor J. Bergonie, of Bordeaux, France, for his Application of Electro-Magnetic Mean and Apparatus to the Location of metallic fragments imbedded in Muscular Tissues.

W. Barton Eddison, of Ardsley-on-Hudson, New York, for his inventions and improvements embodied in the Surface Combustion Burner.

B. H. Hite, of Morgantown, West Virginia, for his Method of Sterilization by High Pressure.

Goddank L. Kothny, of Philadelphia, Pennsylvania, jointly with Robert

Suczek, for his inventions embodied in the Radojet Air Pump.

Jacob M. Spitzglass, of Chicago, Illinois, for his inventions embodied in the Republic Flow Meter.

Robert Suczek, of Philadelphia, Pa., jointly with Goddank L. Kothny, for his inventions embodied in the Radojet Air Pump.

Erskine D. Williamson, of Washington, D. C., for the paper prepared in conjunction with Leason H. Adams, entitled "The Annealing of Glass," in the JOURNAL.

THE CERTIFICATE OF MERIT.

Eugene C. Bingham, of Easton, Pa., for the inventions and improvements embodied in the Variable Pressure Viscometer.

Joseph S. Hepburn, of Philadelphia, Pennsylvania, for the paper prepared in conjunction with E. Quintard St. John and Frank Morton Jones, entitled "The Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ," in the JOURNAL.

Frank Morton Jones, of Wilmington, Delaware, for the paper prepared in conjunction with Joseph S. Hepburn and E. Quintard St. John, entitled "The Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ," in the JOURNAL.

E. Quintard St. John, of Philadelphia, Pennsylvania, for the paper prepared in conjunction with Joseph S. Hepburn and Frank Morton Jones, entitled "The Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ," in the JOURNAL.

FRANKLIN MEDAL AWARDS

1915-1921.

ARRHENIUS, SVANTE AUGUST.

"In recognition of his notable contributions to the theory of physical science which have found unprecedentedly extended and fruitful application in the experimental study of chemical, physical, biological and cosmic phenomena, as well as in industrial chemistry."

1920.

CARTY, JOHN J.

"In recognition of his long-continued activities in the telephone service, his important and varied contributions to the telephone art, his work in the establishment of the principles of telephone engineering, and his signal success in directing the efforts of a large staff of engineers and scientists to the accomplishment of the telephonic transmission of speech over vast distances."

1916.

DEWAR, SIR JAMES.

"In recognition of his numerous and most important contributions to our knowledge of physical and chemical phenomena, and his great skill and inventive genius in attacking and solving chemical and physical problems of the first magnitude."

1919.

EDISON, THOMAS ALVA.

"In recognition of the value of numerous basic inventions and discoveries forming the foundation of world-wide industries, signally contributing to the well-being, comfort and pleasure of the human race."

1915.

FABRY, CHARLES.

"In recognition of his numerous and highly important contributions in the field of physical science, particularly the solution of optical and spectroscopical problems of fundamental importance." 1921.

LORENTZ, HENDRIK ANTOON.

"In recognition of his researches which have so largely contributed to laying on a new foundation our knowledge of the nature of light and in developing our ideas concerning the ultimate construction of matter."

1917.

MARCONI, GUGLIELMO.

"In recognition of his brilliant inception and successful development of the application of magneto-electric waves to the transmission of signals and telegrams without the use of metallic conductors."

1918.

MENDENHALL, THOMAS CORWIN.

"In recognition of his fruitful and indefatigable labors in physical research, particularly his contributions to our knowledge of physical constants and electrical standards."

1918.

ONNES, HEIKE KAMERLINGH.

"In recognition of his long-continued and indefatigable labors in low-temperature research, which have enriched physical science, not only with a great number of new methods and ingenious devices, but also with achievements and discoveries of the first magnitude."

1915.

PARSONS, SIR CHARLES ALGERNON.

"In recognition of his epoch-making success in the development of the steam turbine, which has revolutionized the art of steam engineering, particularly in regard to the propulsion of mercantile and naval vessels and the driving of electrical generators."

1920.

RICHARDS, THEODORE WILLIAM.

"In recognition of his numerous and important contributions to inorganic, physical and theoretical chemistry, and particularly his classical series of redeterminations of the atomic weights of the more important chemical elements."

1916.

SPRAGUE, FRANK J.

"In recognition of his many and fundamentally important inventions and achievements in the field of electrical engineering, notably his contributions to the development of the electric motor and its application to industrial purposes, and in the art of electric traction, signally important in forming the basis of world-wide industries and promoting human welfare."

1921.

SQUIER, GEORGE OWEN.

"In recognition of his valuable contributions to physical science, his important and varied inventions in multiplex telephony and telegraphy and in ocean cabling and his eminent success in organizing and directing the air and signal services of the U. S. Army in the World War."

1919.

TAYLOR, DAVID WATSON.

"In recognition of his fundamental contributions to the theory of ship resistance and screw propulsion and of his signal success in the application of correct theory to the practical design of varied type of war vessels in the United States Navy."

1917.

CRESSON MEDAL AWARDS.

1856-1921.

ACKER, C. E.

Process of Manufacturing Caustic, etc.—1902.

ALBERT, CHARLES F.

Violins and Bows.—1887.

AMERICAN COTTON COMPANY.

Round Lap Bale System.—1901.

AMERICAN PAPER BOTTLE COMPANY.

Paper Bottles for Various Purposes.—1906.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY.

Contributions to the Modern Telephone Art.—1916.

ATWATER, W. O., and ROSA, E. B.

Respiration Calorimeter.—1900.

AUTOMATIC ELECTRIC COMPANY.

Automatic Telephony.—1910.

BAEYER, J. F. A. VON.

Research Work in Organic Chemistry.—1912.

BALDWIN LOCOMOTIVE WORKS.

Contributions to the Evolution of the American Locomotive.—1907.

BATCHELLER, C. H.

Compound Locomotive.—1893.

BATES, STOCKTON; SHAW, EDWIN, and VON CULIN, G. M.

Spindle Support.—1891.

BELL, ALEXANDER GRAHAM.

Electrical Transmission of Speech.—1912.

BERLINER, EMILE.

Telephony and Sound Reproduction.—1913.

BEVINGTON, J. H.

Welding Metal and Spinning and Shaping Tools.—1891.

BILGRAM, HUGO.

Bevel Gear Cutter.—1887.

BONWILL, W. G. A.

Electro-Magnetic Dental Mallet.—1876.

BORSCH, DR. LOUIS.

Solid Invisible Bifocal Lens.—1907.

BOWER, HENRY.

Inodorous Glycerine.—1878.

BRASHEAR, JOHN A.

Leading Work in Astronomic Science.—1910.

CASTNER, H. Y.

Electrolytic Process of Decomposing Alkaline Chlorides for the Production of Caustic and Chlorine.—1897.

CHABOT, CYPRIEN.

Shoe Sewing Machine.—1885.

- CHAMBERS BROTHERS.
Bolt and Rivet Clipper.—1878.
- CHARLTON, J.
Shaft Coupling.—1876.
- CLAMER, G. H.
Methods of Eliminating Metals from Mixtures of Metals.—1904
- COOPER-HEWITT, P.
Mercury Rectifier.—1910.
- CORSCADEN, T.
All-Wrought Steel Belt Pulley.—1898.
- COWLES, EUGENE H., AND ALFRED, H.
Electric Smelting Furnace.—1887.
- COWPER, EDWARD A., AND ROBERTSON, T. HART.
Writing Telegraph.—1889.
- CROOKES, SIR WILLIAM.
Discoveries in Chemistry.—1912.
- CURIE, PROF. AND MADAME.
Researches Resulting in the Discovery of Radium.—1909.
- DELANDTSHEER, NORBERT.
Machine for Treating Flax.—1879.
- DELANY, P. B.
Synchronous Multiplex Telegraphy.—1886.
- DELANY, P. B.
System of Machine Telegraphy.—1896.
- DELANY, P. B.
Telepost.—1908.
- DIESEL, R.
Diesel Motor.—1901.
- DODGE, J. M.
System of Storing Coal.—1904.
- DUDLEY, P. H.
Dynamograph.—1877.
- EDER, J. MARIA.
Researches in Photochemistry.—1914.
- ELDRED, BYRON E.
Low-Expansion Leading-in Wire for Incandescent Electric Lamps.—1921.
- EMMET, WILLIAM LEROY.
Work on Electrical Propulsion of Ships and Prime Movers.—1920.
- FERRILL, J. L.
Process of Fireproofing Wood.—1903.
- FISCHER, EMIL.
Contributions to Organic Chemistry.—1913.
- FISKE, B. A.
Range Finder.—1892.
- FISS, BARNES, ERBEN & CO.
Worsted Yarns.—1875.

FORBES, JOHN S., AND WATERHOUSE, A. G.

Art of Automatically Heating and Sterilizing Fluids.—1901.

FRITZ, JOHN.

Advancement of Steel Industries.—1910.

GAEDE, W.

Molecular Air Pump.—1909.

GANS, ROBERT.

Permutit.—1916.

GAYLEY, J.

Dry Air Blast in Blast Furnace Operation.—1909.

GILL, W. L.

School City.—1903.

GOLDSCHMIDT, HANS.

Alumino-thermics.—1904.

GOLDSCHMIDT, V.

New Theory of Musical Harmony.—1903.

GRAY, E.

Telautograph.—1897.

GRAY NATIONAL TELAUTOGRAPH COMPANY.

Telautograph.—1912.

GRISCOM, W. WOODNUTT.

Electric Motor and Battery.—1881.

HADFIELD, ROBERT A.

Advancement of Metallurgical Science.—1910.

HAMMER, W. J.

Historic Collection of Incandescent Electric Lamps.—1906.

HAMMOND, J.

Typewriter.—1890.

HAUPT, L. M.

Reaction Breakwater.—1901.

HAYES, MAYER AND COMPANY.

Manufacture of Files.—1890.

HEANY, J. ALLEN.

Fireproof Insulated Wire.—1907.

HERSCHEL, CLEMENS.

Venturi Meter.—1898.

HOLLERITH, H.

Electric Tabulating Device.—1890.

HOLMES, P. H.

Lubricant Bearing.—1892.

HOUGH, R. B.

Contributions to the Characteristics and Uses of the American Woods.—1908.

HOWE, H. M.

Experimental Research on Steel.—1895.

HOWE, H. M.

Metallurgy of Steel.—1892.

- IVES, FREDERICK E.
Color Photography.—1893.
- JENKINS, C. FRANCIS.
"Phantoscope."—1898.
- LANSTON, T.
Monotype Machine.—1896.
- LEVY, L. E.
Acid Blast Method and Apparatus for Etching Metal Plates.—1900.
- LEVY, L. E.
Machine for Powdering Plates for Etching.—1904.
- LEWIS, COL. ISAAC NEWTON.
Machine Gun.—1918.
- LINDE, KARL P. G.
Refrigeration Processes.—1914.
- LOWE, THADDEOUS S. C.
Water Gas Process and Apparatus.—1886.
- LOVEKIN, L. D.
Expanding and Flanging Machinery and Tools for all Classes of Tubes.—1904.
- LUMIÈRE, AUGUSTE AND LOUIS.
Color Photography.—1909.
- MALLET, A.
Articulated Compound Locomotive.—1908.
- MARKS, G. E.
Improvements in Artificial Limbs.—1893.
- MASON AND HAMLIN COMPANY.
Liszt Organ.—1901.
- MERGENTHALER, O.
Linotype.—1889.
- MICHELSON, A. A.
Work in Physical Optics.—1912.
- MOISSAN, HENRI.
Investigations with the Electric Furnace.—1898.
- MORLEY, E. W.
Determination of Fundamental Magnitudes in Chemistry.—1912.
- NOBLE, ALFRED.
Achievements in Civil Engineering.—1912.
- NORTHROP, EDWIN F.
Electric Furnace and High Temperature Investigations.—1917.
- OLSEN, TINIUS.
Testing Machine.—1891.
- OTT AND BREWER.
China and Porcelain Wares.—1886.
- OUTERBRIDGE, A. E. JR.
Molecular Structure of Cast Iron.—1904.

- OWENS, MICHAEL J.
Bottle Blowing Machine.—1915.
- PARKER, J. C.
Steam Generator.—1902.
- PECKOVER, J.
Stone Sawing Machine.—1895.
- PELTON, LESTER A.
Water Wheel.—1894.
- PENCOYD IRON WORKS.
Bridge Contruction.—1900.
- PHILLIPS, F.
Pressed Steel Pulley for Power Transmission.—1907.
- POWERS AND WEIGHTMAN.
Exhibit at The Franklin Institute Exhibition of 1874.—1875.
- PRATT AND WHITNEY COMPANY.
System of Interchangeable Cut Gears.—1886.
- PUPIN, M. I.
Art of Reducing Attenuation of Electrical Waves and Apparatus.—1905.
- RAMSAY, R. H.
Railway Car Transfer Apparatus.—1886.
- RAMSAY, SIR WILLIAM.
Discoveries in Chemistry.—1913.
- RANDOLPH, ISHAM.
Achievements in Civil Engineering.—1913.
- RAYLEIGH, LORD.
Researches in Physical Science.—1913.
- ROBERTSON, T. HART AND COWPER, ED. A.
Writing Telegraph.—1889.
- ROENTGEN, W. C.
Investigations of a New Kind of Ray.—1897.
- ROSCOE, SIR H. E.
Researches in Chemistry.—1912.
- RUTHERFORD, ERNEST.
Advancement of Knowledge of Electrical Theory.—1910.
- SAUVEUR, A.
Metallography of Iron and Steel.—1910.
- SHAW, EDWIN; BATES, STOCKTON; VON CULIN, G. M.
Spindle Support.—1891.
- SHAW, THOMAS.
Automatic Device for Testing Mine Gases and System of Mine Signalling.—1887.
- SIMONDS, G. F.
Universal Rolling Machine.—1889.
- SMITH, EDGAR F.
Work in Electrochemistry.—1914.
- SPELLIER, LOUIS H.
Time Telegraph.—1881.

- SPRAGUE, F. J.
Multiple Unit System of Electric Traction.—1903.
- SQUIER, MAJOR GEO. OWEN.
Multiplex Telephony.—1912.
- STEINMETZ, C. P.
Application of Analytics to Electrical Engineering.—1913.
- STRATTON, S. W.
Leading Work in Metrology.—1912.
- TALBOT, B.
Open Hearth Steel Process.—1909.
- TATHAM, W. P.
Printing Press.—1875.
- TAYLOR, E. R.
Electric Furnace and Process of Manufacturing Bisulphide of Carbon.—1907.
- TAYLOR, FREDERICK W., AND WHITE, MAUNSEL.
Process of Treating Tool Steel.—1902.
- TESLA, NIKOLA.
Alternating Electric Currents of High Frequency.—1894.
- THOMSON, ELIHU.
Industrial Applications of Electricity.—1912.
- THOMSON, JOSEPH J.
Leading Work in Physical Science.—1910.
- TILGHMAN, B. C.
Sand Blast.—1875.
- TURNER, W. V.
Air Brake Design and Application.—1909.
- U. S. GEOLOGICAL SURVEY.
Exhibit of Survey.—1900.
- UNDERWOOD TYPEWRITER COMPANY.
Typewriter.—1909.
- VAUCLAIN, S. M.
Compound Locomotive.—1891.
- VERNAZ, ALEXIS.
Milling Files.—1909.
- VON CULIN, G. M.; BATES, STOCKTON; SHAW, E.
Spindle Support.—1891.
- WALKUP, L.
Air Brush.—1886.
- WATERHOUSE, A. G., AND FORBES, JOHN S.
Art of Automatically Heating and Sterilizing Fluids.—1901.
- WELSBACH, CARL AUER VON.
Incandescent Mantles.—1901.
- WESTON, EDWARD.
Leading Work in Electrical Discovery and Application.—1910.

WHITE, MAUNSEL, AND TAYLOR, FREDERICK W.

Process of Treating Tool Steel.—1902.

WILCKES, J.

"Econometer."—1898.

WILEY, HARVEY W.

Leading Work in Agricultural Chemistry.—1910.

WOOD, H. A. WISE.

Autoplate Machine.—1909.

WRIGHT, ORVILLE.

Work in Aviation.—1914.

YANKO, PAUL VON.

Piano Keyboard.—1893.

ZENTMAYER, JOSEPH.

Microscopes and Objectives.—1875.

POTTS MEDAL AWARDS.

1911-1921.

BARKER, WENDELL A.

Wrenchless Chuck.—1920.

BIZZELL, JAMES A., AND LYON, T. L.

"Plants and Relation to Nitrate in Soils" (Paper).—1912.

BONE, WILLIAM A.

"Surface Combustion" (Paper).—1913.

BULLARD, EDWARD P., JR.

Multi-Au-Matic Machine Tool.—1920.

COBLENTZ, W. W.

"Reflecting Power of Metals" (Paper).—1911.

DAHLGREN, ULRIC.

"The Production of Light by Animals" (Paper).—1917.

GRAY, ALEXANDER.

"Modern Dynamo Electric Machinery" (Paper).—1918.

HUMPHREYS, WILLIAM J.

"The Thunderstorm and Its Phenomena" (Paper).—1915.

JANNEY, REYNOLD, AND WILLIAMS, HARVEY D.

Hydraulic Speed Gear.—1919.

KENNELLY, A. E.

Linear Hot-Wire Anemometer.—1918.

KING, LOUIS V.

Improvements in Linear Hot-Wire Anemometers.—1918.

LANDRETH, CLARENCE P.

Direct Oxidation Process.—1919.

LYON, T. L., AND BIZZELL, JAMES A.

"Plants and Relation to Nitrate in Soils" (Paper).—1912.

McCOLLUM, E. V.

"Nutrition and Physical Efficiency" (Paper).—1921.

MODJESKI, RALPH.

"Design of Large Bridges with Special Reference to Quebec Bridge" (Paper).—1914.

MURRAY, W. S.

"Conditions Affecting the Success of Main Line Electrification" (Paper).—1916.

TATE, ALFRED O.

Electrolytic Waterproofing of Textile Fabrics.—1921.

WILLIAMS, HARVEY D., AND JANNEY, REYNOLD.

Hydraulic Speed Gear.—1919.

LONGSTRETH MEDAL AWARDS.

1890-1921.

ABBE, C.

"Meteorology" (Paper).—1913.

ABBOTT, ROBERT R.

"Modern Steels and Their Heat Treatment" (Paper).—1916.

ACHARD, F. H., KENNELLY, A. E., DANA, A. S.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—1917.

ADAMS, L. H., AND WILLIAMSON, E. D.

"The Annealing of Glass" (Paper).—1921

ADAMS, W. G., AND FORBES, J. S.

Stop Valve for Radiators.—1893.

ALEXANDER, JOHN E.

"Phonosphere."—1905.

ALTENEDEK, THEODORE AND SONS.

Drawing Pen.—1905.

ARMSTRONG, WM. T., AND COX, JACOB D.

Grip Socket.—1896.

ARNOLD, B. J.

Magnetic Clutches and System of Electric Power Station Construction.—1903.

AUSTIN, JOHN T.

Austin Organ.—1917.

BALL, JOHN D.

"Investigations of Magnetic Laws for Steel and Other Materials" (Paper).—1917.

BASKERVILLE, C.

"Chemistry of Anæsthetics" (Paper).—1912.

BATES, E. G.

Typographic Numbering Machine.—1895.

BAUSH, CHRISTIAN H.

Radial Drilling Machine.—1894.

BECKER, CHRISTOPHER A.

Chainomatic Balance.—1917.

BENNETT, CHARLES A.

Typewriter.—1909.

BERGONIE, J.

Use of A. C. Electro-Magnet in Surgery.—1921.

BLOEDE, V. G.

Process of Tinting Fabrics.—1894.

BONNELL, RUSSELL, AND SCHMITT, HENRY J.

Gate Valves.—1901.

BRADBURN AND PENNOCK.

Process of Obtaining Alumina from Bauxite.—1893.

BREED, G.

Apparatus for Producing Musical Sounds by Electricity.—1908.

BRISTOL, W. H.

Recording Pressure Gauge.—1894.

BROWN, HAROLD P., AND EDISON, THOMAS A.

Rail Bonds and Electrical Contacts.—1899.

CAFFREY, C. S., AND COMPANY.

Improvement in Carriages and Wagons.—1900.

CARTY, J. J.

Bridging Bell System.—1905.

CHAFFEE, E. L.

"Continuous Electric Oscillations" (Paper).—1913.

CHANCE, E. M.

"Pathogenic Mine Atmospheres" (Paper).—1912.

CHENEY, W. L.

Lathe Tool and Support.—1895.

CHENOWETH, A. C.

Method of Constructing Sewers.—1892.

CLARK, WM. H., AND COLLINS, FRANK W.

Cortlandt, Howe Ventilating Stove.—1894.

COLLINS, FRANK W., AND CLARK, WM. H.

Ventilating Stove.—1894.

COLT'S PATENT FIRE ARMS MANUFACTURING COMPANY.

Automatic Pistols.—1906.

COOPER, W. S.

Specimens of Aluminum Castings.—1895.

COX, JACOB D., AND ARMSTRONG, WM. T.

Grip Socket.—1896.

CREIGHTON, H. JERMAIN.

"The Deteriorating Action of Salt and Brine on Reinforced Concrete"
(Paper).—1918.

CRISFIELD, J. A. P.

Moisture Determinator for Coke and the Like.—1909.

- CUMMINGS, H. H.
Speed Controllers.—1903.
- CUSHMAN, ALLERTON S.
"Researches on the Corrosion of Iron and Steel" (Paper).—1908.
- DANA, A. S., KENNELLY, A. E., ACHARD, F. H.
"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—1917.
- DESHLER, CHARLES, and McALLISTER, EDWARD J.
Portable Photometer.—1900.
- DEVoe, W. R.
Conduit Electric Railway.—1894.
- DODGE, WALLACE H.
Wooden Split Pulley.—1891.
- DOOLITTLE, T. B.
Hard Drawn Copper Wire.—1898.
- DRAPER, C. W.
Computing Machine with Indicating and Registering Mechanism.—1904.
- EBERHARDT, HENRY F., and ULRICH, F. L.
Radial Gang Cutter.—1904.
- EDDISON, WILLIAM BARTON.
Jet Entraining Apparatus.—1921.
- EDISON, THOMAS A., and BROWN, HAROLD P.
Rail Bonds and Electrical Contacts.—1899.
- EDWARDS, LEVI TALBOT.
Compound Air-Lift System.—1918.
- ELLIS, CARLETON.
Paint and Varnish Remover.—1916.
- EVE, A. S.
"Modern Views on the Construction of the Atom" (Paper).—1916.
- FAY, C. N., SHOLES, Z. G., and HOCHKLASSEN, H.
Typewriting Machine.—1901.
- FOLLETT, W. I.
Time Stamp.—1906.
- FOLMER AND SCHWING MFG. COMPANY.
Graflex Cameras.—1905.
- FORBES, J. S., and ADAMS, W. G.
Stop Valve for Radiators.—1893.
- FRICK, FRED.
Electric Program Clock.—1899.
- FULLER, G. W.
"Biochemical and Engineering Aspects of Sanitary Water Supply" (Paper).—1916.
- GOLDMAN, HENRY.
Arithmachine.—1901.

- GOODYEAR, CHARLES.
Projection Lantern.—1895.
- GRANBERY, J. H.
Stadia Rod.—1909.
- HEILPRIN, A.
Improved Ventilating Car Window.—1897.
- HENNING, G. C.
Pocket Recorder for Tests of Materials.—1899.
- HEPBURN, J. S.
"Chemistry of Sugar" (Paper).—1911.
- HERR, H. T.
"Development of Steam Turbines" (Paper).—1914.
- HILL, F. B.
Improvement in the Treatment of Sewage.—1893.
- HIRSCH, H. H.
Electric Safety Lamp.—1914.
- HITE, B. H.
Sterilization by High Pressure.—1920.
- HOADLEY, H. G.; WILLIAMS, H. D.; LEWIS, E. C.
Lever and Ratch Attachment.—1900.
- HOCHKLASSEN, H.; FAY, C. N., AND SHOLES, Z. G.
Typewriting Machine.—1901.
- HOLLINGSHEAD, W. B.
Automatic Disinfectant Ejector.—1898.
- HOLMAN, A. J., AND COMPANY.
Self-Pronouncing Bibles.—1900.
- HOOVEN, OWENS, RENTSCHLER Co.
Hooven Automatic Typewriter.—1917.
- HUMPHREYS, W. J.
"Volcanic Dust, Climatic Changes and Ice Ages" (Paper).—1914.
- HYDE, E. P.
"Physical Production of Light" (Paper).—1911.
- INTERNATIONAL LIGHT, HEAT AND POWER COMPANY.
Incandescent Lamp.—1901.
- INTERNATIONAL MONEY MACHINE COMPANY.
Money Machine.—1917.
- IVES, H. E., KINGSBURY, E. F., KARRER, E.
"The Physics of the Welsbach Mantle" (Paper).—1919.
- IVES, H. E.
"Artificial Daylight" (Paper).—1915.
- IVES, H. E.
Improvements in Diffraction Color Photographs and Mode of Making Same.—1907.
- IVES, F. E.
Photo-Micrographic Process.—1903.

IVINS, E.

Product of Tube Making.—1894.

JOHNSTON, A. L.

Automatic Safe Electric Disconnecter.—1894.

JONES, H. C.

"Nature of Solution" (Paper).—1913.

JONES, J. R.

Machine for Rolling Car Wheels.—1892.

KARNS, J. P., COMPANY.

Tunneling Machine.—1909.

KARRER, E.; KINGSBURY, E. F.; IVES, H. E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

KEMP, W. W., AND VAN HORN, W. H.

Gas System.—1919.

KENNELLY, A. E.; ACHARD, F. H.; DANA, A. S.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).
—1917.

KINGSBURY, E. F.; KARRER, E.; IVES, H. E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

KINKEAD MANUFACTURING COMPANY.

Apparatus for Aligning and Levelling Shafting.—1914.

KITSON, A.

System of Oil Heating and Incandescent Lighting.—1901.

KNAPP, I. N.

"Natural Gas" (Paper).—1913.

KOTHNY, G. L., AND SUCZEK, ROBERT.

Radojet Air Pump.—1920.

KROLL, G.

Convertible Carriage.—1896.

LAIRD, SCHOBER AND COMPANY.

General Excellence in Manufacturing Shoes.—1900

LATHROP, E., AND SCHREINER, O.

"Organic Constituents in Soil" (Paper). 1912.

LEDoux, J. W.

Fluid Meter.—1919.

LEEDS, MORRIS E.

Recording Devices.—1920.

LENKER, WILL G.

L-E-Vation Rod.—1915.

LEVY, MAX

Counting Chamber for Haemocytometer.—1917.

LEWIS, E. C.; WILLIAMS, H. D.; HOADLEY, H. G.

Lever and Ratch Attachment.—1900.

LEWIS, JOHN F., AND MATTES, WM. F.

Locomotive Cylinder Lubricator.—1894.

LEWIS, W.

Inertia Indicator.—1899.

LLOYD, M. G.

"Magnetic Hysteresis" (Paper).—1911.

LODGE, GEORGE.

Electro-Magnetic Street Railway System.—1896.

LUCKIESH, M.

"The Visibility of Airplanes" (Paper). 1920.

LUPTON, D., SON AND COMPANY.

Automatic Closing Fireproof Metal Window.—1904.

MACKAY, WILLIAM M.

Operating Valve.—1893.

MCALLISTER, E. J., AND DESCHLER, CHARLES.

Portable Photometer.—1900.

MARSH, E. B.

Metallic Corner Bead.—1897.

MATTES, WILLIAM F., AND LEWIS, J. F.

Locomotive Cylinder Lubricator.—1894.

MEEKER, G. H.

New Apparatus and Method in Clinical Chemistry.—1906.

MENLO PARK CERAMIC WORKS.

Decorative Tile and Faience Work.—1890.

MILEY, HENRY M., AND MICHAEL.

Color Photography.—1905.

MILLER, DAYTON C.

"A 32-Element Harmonic Synthesizer" (Paper).—1917.

MOORE, RICHARD B.

"Biography of Sir William Ramsay" (Paper).—1919.

MORSELL, W. F. C.

Sectional Models for Stereometric Representation.—1903.

NORTHROP, E. F.

"Vortex Motion in Liquids" (Paper).—1912.

PANTASOTE LEATHER COMPANY.

"Pantasote."—1896.

PHILADELPHIA CREMATION SOCIETY.

System of Cremation.—1892.

PITKIN, A. J.

Compound Locomotive.—1891.

PITTLER, J. W., VON

Turret Lathe.—1903.

PRESTWICH, JOHN ALFRED.

Fluid Gauge.—1918.

- RANKIN, GEORGE A.
"Portland Cement" (Paper).—1917.
- RECKLINGHAUSEN, M. VON.
"Ultra-Violet Rays" (Paper).—1915.
- REESE, B. D.
Dirigible Balloon.—1910.
- REEVES, MILTON O.
Variable Speed Countershaft.—1900.
- REGAN, H. C., JR.
Closed Conduit Electric Railway.—1897.
- RICHARDS, G. M.
Automatic Fluid Pressure Friction Clutch.—1897.
- RIKER, C. L.
Lavatory.—1900.
- RINGLAND, ALBERT, AND SCHOENFUSS, F. H.
Portable Brinell Meter.—1917.
- ROBY, HENRY W.
Screw Jack.—1891.
- ROEDER, J. R.
Improvement in Windows.—1892.
- ROPER, CHARLES.
Safety Propellers.—1909.
- ROSENDALE BELTING COMPANY.
Camel Hair Belting.—1893.
- ROUSSEL, W. J.
Cipher Code System.—1902.
- RUSBY, J. M.
"Industrial Combustible Gases" (Paper).—1914.
- RUSHTON, K.
Improvements in Trailing Trucks for Locomotives.—1910.
- RUUD, EDWIN.
Instantaneous Automatic Water Heater.—1904.
- SCHEMERHORN, W. GEORGE.
Folding Boat.—1891.
- SCHLINK, FREDERICK J.
Stabilized Platform Weighing Scale.—1919.
- SCHMIDT, MAX, AND SIEBER, JOSEPH.
Movable Sidewalk.—1894.
- SCHMIDT, HENRY J., AND BONNELL, RUSSELL.
Gate Valves.—1901.
- SCHOENFUSS, FRANK H., AND RINGLAND, ALBERT.
Portable Brinell Meter.—1917.
- SCHREINER, O., AND LATHROP, E.
"Organic Constituents in Soils" (Paper).—1912.
- SCRIPTURE, E. W.
Color Sense Tester.—1903.

- SEITZ, HENRY JEROME.
Coal Loading and Screening Machines.—1904.
- SHARPLES, SPECIALTY COMPANY.
Super-Centrifuge.—1916.
- SHAW, H. M.
Lightning Arrester.—1904.
- SHELLENBACH, WILLIAM L.
Variable Speed Countershaft.—1903.
- SHOLES, Z. K.; FAY, C. N.; HOCHKLASSEN, H.
Typewriting Machine.—1901.
- SIEBER, JOSEPH, AND SCHMIDT, MAX E.
Movable Side-Walk.—1894.
- SKINNER, JOSHUA J.
"Soil Aldehydes" (Paper).—1919.
- SNOOK, HOMER CLYDE.
X-Ray System.—1919.
- SPITZGLASS, JACOB M.
Republic Flow Meter.—1921.
- STAR BRASS MANUFACTURING COMPANY.
Steam Gauge.—1894.
- STEARNS MANUFACTURING COMPANY.
Automatic High Speed Engine.—1892.
- STONE, JOHN STONE.
"Propagation of Electric Waves Along Wires" (Paper).—1913.
- STRADLING, GEORGE F.
"Modern Theories of Magnetism" (Paper).—1916.
- STUMPF, J.
Una Flow Steam Engine.—1909.
- SUCZEK, ROBERT, AND KOTHNY, G. L.
Radojet Air Pump.—1920.
- TAINTOR, C. C.
Positive Saw-Set.—1895.
- TAUSSIG, JOHN H., AND ZEEK, CHARLES F.
Automatic Operation of Water Gas Sets.—1918.
- TEAL, B. F.
Anti-friction Universal Joint for Shafting.—1909.
- THOMAS, C. C.
"Measurement of Gases" (Paper).—1912.
- TOERRING, C. J.
Electric Arc Lamp.—1903.
- TOWNSEND, T. F.
Improved Thermometer Support.—1907.
- TUCKER, W. H.
Letter and Document Files.—1900.
- TURNER, W. V.
"Locomotive Air-Brake" (Paper).—1911.

- TUTWILER, C. C.
"Recovery of Gas Works by-Products" (Paper).—1915.
- ULRICH, FREDERICK L., AND EBERHARDT, H. E.
Radial-Duplex Gang Cutters.—1904.
- UNDERWOOD, JOHN, AND COMPANY.
Combined Calculating and Typewriting Machine.—1915.
- VAN ALLER, TYCHO.
Calorizing Process.—1918.
- VAN HORN, WILLIAM H., AND KEMP, WILLIAM W.
Kemp Gas System.—1919.
- WAGGNER, B. G.
Prepayment Gas Meter.—1916.
- WAGNER ELECTRIC MANUFACTURING COMPANY.
Single Phase Alternating Current Power Motor.—1902.
- WAHL ADDING MACHINE COMPANY.
Adding Machine.—1916.
- WATERBURY TOOL COMPANY
Double Univesal Joint.—1904.
- WEIDLOG, CHARLES B.
Indicator for Boring Machines.—1906.
- WELSBACH LIGHT COMPANY.
Various Manufactured Products.—1901.
- WENTWORTH, C. C.
Improvements in Hydraulic Rams.—1903.
- WETHERILL, HENRY EMERSON.
New Physical Diagnostic Instruments.—1906.
- WHEELER, GEORGE A.
Step Type Escalator.—1914.
- WHITE, J. J.
Journal Box.—1891.
- WHITEHEAD, J. B.
"The Electric Strength of Air and Methods of Measuring High Voltage" (Paper).—1918.
- WILLIAMS, BROWN AND EARLE.
Kerosene Lamp for Magic Lanterns.—1902.
- WILLIAMS, H. D.; HOADLEY, H. G.; LEWIS, E. C.
Lever and Ratch Attachment.—1900.
- WILLIAMSON, E. D., AND ADAMS, L. H.
"The Annealing of Glass" (Paper).—1921.
- YAWMAN & ERBE MANUFACTURING COMPANY.
Rapid Roller Copier.—1904.
- YOUNG, C. D.
"Locomotive Superheaters" (Paper).—1915.
- ZEEK, CHARLES F., AND TAUSSIG, JOHN H.
Automatic Operation of Water Gas Set.—1918.

CERTIFICATE OF MERIT AWARDS.

1885-1921.

BAYLIS, R. N.

Brush Holder and Brusher for Dynamos.—1909.

BEIN, EMIL J.

Letter and Document Files.—1900.

BLANTON, E. A., JR.

Shaft Coupling, Nut Locks, Cams, etc.—1910.

BLONCK, W. A.

Boiler Efficiency Meter.—1914.

BLOUNT, EUGENE I., AND TAYLOR, WARREN H.

Door Check.—1902.

BRANCH, C. J.

Electric Light Shade.—1909.

BYERLY, F. E.

Cutter and Cutter Head.—1893.

CANDEE, C. H.

Car Truck and Journal Bearings.—1887.

COOK, J. S.

Self-Lubricating Journal Box.—1898.

DEMPSTER, J. T. H.; FLEMING, RICHARD; GENERAL ELECTRIC COMPANY; STEINMETZ, C. P.

Magnetic Lamp.—1908.

DERYCKE, J.

Steam Separator.—1894.

DODGE, W. W.

Wooden Split Pulley.—1885.

DUNN, G. S.

Automatic Electric Brake Motor.—1902.

ELLSWORTH, F. G.

The Knudson and Ellsworth Telephone.—1891.

ELTONHEAD, W. B.

Nut Lock.—1885.

FLEMING, RICHARD; DEMPSTER, J. T. H.; GENERAL ELECTRIC COMPANY; STEINMETZ, C. P.

Magnetic Lamp.—1908.

GENERAL ELECTRIC COMPANY; DEMPSTER, J. T. H.; FLEMING, RICHARD; STEINMETZ, C. P.

Magnetic Lamp.—1908.

GETTY, JOHN K.

Bicycle Support.—1896.

GILSON, EMERY G.

Calorizing Process.—1918

GLAZIER, JOHN T. AND PETER F.

Universal Nozzle.—1904.

GOWDEY, J.

Compartment Drawer.—1902.

GREENE, F. V. AND M. A.

Improvement in Windows.—1892.

HAINES, R. B., JR.

Automatic Micrometer Gauge for Hot Metal.—1896.

HALLANAN, M.

Horseshoe and Pad.—1896.

HALLBERG, J. H.

Current System for Trunk Line Railways.—1906.

HANSON, FREEMAN.

Wood Turning Machine.—1891.

HARBOLSHEIMER, J.

Garbage Box.—1894.

HAVARD, OLIVER D.

Coal Meter.—1918.

HAYS, CHARLES AND JOSEPH.

CO₂ and Draft Recorder.—1920.

HEPBURN, J. S.; ST. JOHN, E. Q.; JONES, F. M.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

HILL, EDGAR.

Caliper Measuring Device.—1903.

HILL, MYRON F.

Roller Bearings.—1902.

INTERNATIONAL BURGLAR IMMUNITY CO.

Electric Protective Devices.—1905.

JONES, FRANK MORTON; HEPBURN, J. S.; ST. JOHN, E. Q.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

KINNEY, R. D.

Internal Fired Water Tube Boiler.—1899.

LANCE, W. L.

Utilizing Oil Cloth Waste.—1888.

LAND, S.

Sash Cord Fastener.—1886.

LANDAU, DAVID, AND PARR, PERCY H.

"A New Theory of Plate Springs" (Paper).—1920.

MCCHESNEY, R.

Improved in T-Squares.—1893.

MACDONALD, THOMAS H.

Apparatus for Recording Sound.—1900.

McINTYRE COMPANY.

Electric Wire.—1893.

McLAUTHLIN, MARTIN B., AND TAYLOR, GEORGE.

Household Garbage Carbonizer.—1895.

NABER, H. A.

Gas Voltameter.—1895.

NATIONAL NUTRIENT COMPANY.

Nutrium, a new food Product.—1902.

NEUMEYER, H. F.

Spray Nozzle.—1895.

PARR, PERCY H., AND LANDAU, DAVID.

"A New Theory of Plate Springs" (Paper).—1920.

PARVIN, A. B.

Tele-photo Lens.—1895.

PELPHS, W. J.

Hylo-Incandescent Lamp.—1903.

PICH, FRIEDRICH.

Cast Iron Brazing.—1903.

REAGAN, JAMES.

Improved Grates.—1900.

RIDGWAY, E. B.

Steam Hydraulic Elevator.—1914.

RINN, J. J.

Tent Fastening.—1904.

ROBINSON, CYRUS R.

Improved Fire Nozzle.—1905.

ROLIN, CHARLES W.

Adjustable and Interchangeable Grate.—1918.

ROWLAND, L. G.

Automatic Safety Device for Electric Circuits.—1897.

SADTLER, J. P. B.

Water Heater for Range Boilers.—1900.

SCHENCK, W. T. Y.

Improved Hose Reels.—1893.

SHEAF, PHILIP A.

Circle Drawing Attachment for Microscopes.—1916.

SIMPSON, W. L.

Steam Separator.—1894.

STEIN, F. J.

An Improved and Simplified System of Pitman Phonography.—1904.

STEINMETZ, C. P.; DEMPSTER, J. T. H.; FLEMING, RICHARD; GENERAL ELECTRIC COMPANY.

Magnetic Lamp.—1908.

- ST. JOHN, E. Q.; HEPBURN, J. S.; JONES, F. M.
Absorption of Nutrients and Allied Phenomena in the Pitchers of the
Sarraceniaceæ" (Paper).—1921.
- SWEETLAND, ERNEST J.
Metallic Filter Cloth.—1918.
- SWETT AND LEWIS COMPANY.
Static Machine for X-Ray Apparatus.—1899.
- TAYLOR, GEORGE, AND McLAUTHLIN, MARTIN B.
Household Garbage Carbonizer.—1895.
- TAYLOR, WARREN H., AND BLOUNT, EUGENE I.
Door Check.—1902.
- TUCKFIELD, C. B.
Stove Pipe Anchor.—1896.
- VANIER, G. P.
Potash Bulb.—1914.
- WARDEN, J. T.
Improved Drawing Board.—1893.
- WEBER AND COMPANY.
Speaking Attachment for Telephone.—1894.
- WHINERY, SAMUEL BRENT.
Improved Method of Blueprinting.—1902.
- WHITE, E. M.
Chimney for Incandescent Lamp.—1898.
- WICKERSHAM, W.
Printers' Quoin.—1894.
- WILKES, M.
Automatic Cut-Off for Slide Valve Engines.—1889.

JOHN SCOTT MEDAL AWARDS.

1835-1918.

- ABT, R.
System of Mountain Railways.—1889.
- ACHESON, E. G.
"Carborundum."—1894.
- ACHESON, E. G.
Artificial Graphite.—1901.
- ADT, J. B.
Tobacco Machine.—1901.
- AKELEY, CARL E.
Cement-Gun.—1916.
- ALBERT, C. F.
Musical Instruments.—1901.
- ALGER, H. C.
Liquid Measurer.—1912.

- ALMOND, T. R.
Angular Coupling.—1892.
- ALMOND, T. R.
Flexible Tube.—1897.
- AMERICAN PRISMATIC LIGHT COMPANY.
Light Projecting Glass.—1901.
- ANDERSON, H. N.
Gear Rolling Machine.—1915.
- ANDERSON, LEVI.
File Cutting.—1842.
- ANDERSON, WILLIAM.
Apparatus for Water Purification.—1891.
- ASHFORD, HENRY.
Boat Attaching and Detaching Apparatus.—1883.
- ATKINS, J.
Self-Raking Automatic Reaper and Mower.—1854.
- ATKINSON, J.
Gas Engine.—1889.
- BABBITT, I.
Axle Boxes for Railway Cars.—1840.
- BABBITT, I.
Soft Metal Boxes.—1842.
- BAEKLAND, LEO H.
Bakelite.—1909.
- BAKER, J. G.
Pressure Bower.—1875.
- BALDWIN, F. S.
Calculating Machine.—1874.
- BALDWIN, F. R.
Boiler Tube Cleaner.—1893.
- BALLENTINE, W. I.
Apparatus for Testing Hardness and Density of Metal, etc.—1908.
- BALZER, S. M.
Device for Backing off and Forming Milling Cutters.—1896.
- BARDWELL, JOHN.
Votometer.—1901.
- BASSETT, H.
Compasses.—1835.
- BATCHELLOR, B. C.
Pneumatic Dispatch Tube Apparatus.—1899.
- BATDORF, C. S.
Coin Counting and Wrapping Machine.—1914.
- BATES, ALBERT J.
Improved Corliss Engine.—1895.
- BATES, ROBERT.
Instrument for the Cure of Stammering.—1854.

- BEADLE, C.; BEVAN, E. J.; CROSS, C. F.
Cellulose Products.—1895.
- BEAN, E. W.
Device for Ascertaining Latitude.—1837
- BEECHER, JAMES.
Hollow Handled Cutlery.—1883.
- BEHREND, B. A.
High Speed Electric Generators.—1909.
- BEHRNS, G. L. H., AND BREMAR, A.
Aspirator for Mill Stones.—1877.
- BELL, CHICHESTER A., AND TAINTER, SUMMER.
Apparatus for Recording Sound.—1900.
- BENNOR, JOSEPH.
Siphon Trap.—1884.
- BENNOR, JOSEPH.
Knitting Machine.—1892.
- BERKEFELD, W.
Germ Proof Water Filter.—1893.
- BERLINER, E.
Gramophone.—1897.
- BEVAN, E. J.; BEADLE, C.; CROSS, C. F.
Cellulose Products.—1895.
- BILGRAM, HUGO.
Bevel Gear Cutter.—1887.
- BILGRAM, HUGO.
Gearing for Metal Planners.—1882.
- BILYEU, THOMAS.
International Money Machine.—1917.
- BLAKEY, THOMAS W., AND COURTENAY, WILLIAM.
Reconstructed Granite.—1900.
- BLICKENSBERFER, GEORGE C.
Typewriting Machine. 1901.
- BLODGETT BROTHERS.
Electrical Signal Clock.—1883.
- BLONDEL, ANDRE, AND PAAROWDAKI, SPIRIDION.
Holophone Globes.—1898.
- BRADLEY, ANDREW.
Stencil Machine.—1902.
- BRAMWELL, W. C.
Feeding Machine for Fibrous Material.—1894.
- BRANSON, D.; THORNBURGH, R. D.; STARR, J. E.; FULLER, J. E.
Refrigeration Process.—1894.
- BREHMER, HUGO, AND HEYL, HENRY RAND.
Wire Book Sewing Machine.—1883.
- BREMAR, A., AND BEHRNS, G. L. H.
Aspirator for Mill Stones.—1877.
- BRIDGMAN, H. L.
Automatic Ore Sampler.—1893.

BEALL, J. A.

Convertible Cars, Traction Trucks.—1904.

BETTON, J. W., AND TATHAM, B.

Safety Catch for Elevators.—1875.

BROWN, EDWARD.

Pyrometers.—1897.

BROWNING, JOHN M.

Automatic Pistol.—1906.

BURGER, H. J.

Photo-Polychrome Printing Apparatus.—1903.

BURRELL, JOHN H., AND METZLER, C. E.

Railway Signal Lantern.—1885.

BURROUGHS, W. S.

Calculating Machine.—1897.

BURROWS, AMOS E.

Feed-Water Regulator.—1904.

BURT, W. A.

Variation Compass.—1835.

BURTON, G. D.

Electric Forging Device.—1892.

BURTON, W. L.

Electric Heater.—1890.

CALAHAN, E. A.

Synchronous Multiplex Telegraphy.—1886.

CALDERHEAD, A.

Looms.—1840.

CAMPBELL, P. T., AND C. H.

Apparatus for Reconstructing Milk.—1904.

CARLETON, CYRUS, AND WILCOX, CHARLES H.

Automatic Tension and Improved Sewing Machines.—1875.

CARNELL, CHARLES.

Brick Machine.—1850.

CARNEY, THOS.; COOK, H.; AND PATTERSON, H. G. AND J. H.

Cash Registers.—1901.

CARROLL, W. T.

Non-Metallic Bearings.—1896.

CASTNER, H. Y.

Apparatus for the Manufacture of Sodium and Potassium.—1889.

CERASOLI, ALBERTO, AND HUMPHREY, H. A.

Hydraulic Pump.—1914.

CHABOT, CYPRIEN.

Shoe Sole Channelling Machine.—1885.

CHABOT, CYPRIEN.

Shoe Sewing Machine.—1885.

CHABOT, CYPRIEN.

Shoe Sole Edge Turning Machine.—1885.

- CHABOT, CYPRIEN.
Beveled Rim Watch Cases.—1886.
- CHAMBERS, C.
Brick Machine.—1875.
- CHAMBERS, C.
Book Folding and Pasting Machine.—1874.
- CHAUVENET, WILLIAM.
Great Circle Protractor.—1857.
- CHENOWETH, A. C.
Electric Conduits.—1890.
- CHENOWETH, A. C.
Steel Concrete Foundation Piles.—1906.
- CLARK, G. S.
Device for Safety Vaults.—1892.
- CLAUD, G. M.; HESS, G. A.; FOUICHE, EDMUND.
Process of Storing Explosive Gases.—1903.
- CLEBORNE, C. J.
Bedstead.—1894.
- COLBY, E. A.
Electric Furnace for Melting Metals.—1909.
- COLTON, SABIN W.
Improved Locks.—1848.
- CONNET, FREDERICK N., AND JACKSON, W. W.
Improved Venturi Meter.—1898.
- COOK, H.; CARNEY, T.; PATTERSON, H. G. & J. H.
Cash Registers.—1901.
- COOPER, DANIEL.
Time Recorder.—1898.
- COURTENAY, WILLIAM, AND BLAKEY, THOMAS W.
Reconstructed Granite.—1900.
- COWLES, EUGENE H., AND ALFRED H.
Electric Smelting Furnace.—1887.
- COWPER-COWLES, SHERARD.
Method of Depositing Metals on Metallic Surfaces.—1911.
- CREHORE, A., AND SQUIER, G. O.
Polarizing Photo-Chronograph.—1896.
- CROSS, C. F.; BEADLE, CLAYTON; BEVAN, E. J.
Cellulose Products.—1895.
- CROSS, W. A.
Horizontal Folding Door.—1903.
- CYCLOSTYLE COMPANY.
Cyclostyle.—1888.
- DALE, JOHN D.
Wood Molding Machine.—1857.
- DARLING, J. D.
Apparatus for Producing Metals and Nitric Acid from Fused Nitrates.—
1901.

- DAVIS, JOB A.
Vertical Feed for Sewing Machine.—1875.
- DENISON, L. C.
Corn Sheller.—1839.
- DIETZ, GUSTAV.
High Speed Photographic Between-lens Shutter.—1909.
- DILKS, J.
Water Gauges.—1853.
- DOBBINS, E. J.
Daylight Rod.—1914.
- DOBBINS, EDWARD J., AND MOFFETT, GEORGE.
Light Projecting Glass.—1901.
- DOBLE, W. A.
Tangential Water Wheel.—1904.
- DOCK, H.
Rivett Thread Tool.—1901.
- DODGE, J. M.
Storage Structure for Coal and Analogous Material.—1904.
- DODGE, WALLACE H.
System of Rope Transmission.—1891.
- DOERR, JOHN H., AND WIGMORE, WILLIAM H.
Sleeping Car.—1885.
- DORR, JOHN V. H.
Hydrometallurgical Apparatus.—1916.
- DOWNES, L. W.
Fireproof Insulated Wire.—1905.
- DRESSLER, CONRAD D'HUC.
Tunnel Kiln.—1918.
- DUNCAN, JOSEPH S.
Addressograph.—1903.
- DUNHAM, JOSEPH M., AND MCKEMMIL, JOHN.
Metallic Drawing Rolls.—1894.
- DUNN, B. W.
Testing Machine for Measuring Intensities of Impulsive Forces.—1898.
- DURKEE, G. B., AND GOLDING, JOHN F.
Expanded Metal.—1897.
- DUTTON, R. & Co.
Mowing Machine.—1877.
- ECKSTEIN, H. G.
Feed Water Heater.—1884.
- EDISON, T. A.
Mimeograph.—1889.
- EDSON, J. B.
Pressure Recording Gauge.—1894.
- FHBETS, C. J.
Improved Revolver.—1890.

- ELDRED, BYRON.
Process for Flame Regulation.—1906.
- ELDRIDGE, G. M.
Electro Magnetic Protector for Electric Instruments.—1884.
- ELLIS, H.
Combined Calculating and Writing Machine.—1909.
- ELMER AND LITTLE.
Chronometer.—1837.
- EMERSON, J.
Power Scale.—1892.
- ENGELHARD, C.
Heraeus Le Chatelier Pyrometer.—1907.
- EWBANK, T.
Lead Pipes.—1835 .
- FABER, GEORGE.
Magnetic Water Gage.—1853.
- FAHY, FRANK P.
Permeameter.—1918.
- FAWKES, JOSEPH W.
Steam Plow.—1859.
- FELLOWS, E. R.
Machine and Cutter for Generating Gear Teeth.—1899.
- FELT, D. E.
Comptometer.—1890.
- FIELD, D. W., AND SPENCER, JOHN E.
Damper Regulator.—1893.
- FISHER, ROBERT T.
Improved Book and Letter Typewriter.—1899.
- FORTEN, R. B.
Telescope.—1840.
- FOUCHE, E.; CLAUD, G. M. A.; HESS, G. M.
Process for Storing Explosive Gases.—1902.
- FRAHM, HERMANN.
Speed Indicator, Frequency Teller and Revolution Counter.—1907.
- FRANCIS, JEROME B.
Tooth Extractor.—1860.
- FRAZER, PERSIFOR.
Apparatus for Quantitative Colorimetry.—1905.
- FULLER, FRED L., AND GRISWOLD, GEORGE H.
Cash Register and Indicator.—1892.
- FULLER, J. E.; BRANSON, D.; THORNBURGH, R. D.; STARR, J. E.
Refrigeration Process.—1894.
- FURBISH, ZACHARY T.
Ratchet Tools.—1904.
- GARROD, R. P.
Annunciators.—1891.

- GATES, JOHN.
Lubricator.—1888.
- GIBBONS, C. L.
Street Railway Construction.—1892.
- GILLESPIE, ALFRED J.
Voting Machine.—1902.
- GLIDDENS, CARLOS; SHOLES, C. L.; SOULE, S. W.
Improved Typewriter.—1875.
- GODDARD, K.
Carriage Axle.—1852.
- GOETZ, G. M.
Device for Anchoring Beams.—1891.
- GOLDBERG, H. E., AND WAHL, J. C.
Adding Machine.—1916.
- GOLDING, J. F., AND DURKEE, G. B.
Expanded Metal.—1897.
- GOLDSTEIN, A.
Pneumatic Fire Alarm Telegraph System.—1895.
- GOODES, E. A.
Sewing Machine.—1875.
- GOODWIN, WILLIAM FARR.
Mowing Machine.—1879.
- GOODYEAR, ROBERT B.
Harness Motion for Power Looms.—1875
- GOODYEAR, ROBERT B.
Shuttle Box Operating Mechanism.—1875.
- GRANT, GEORGE B.
Calculating Machine.—1877.
- GRANT, GEORGE B.
Calculating Machine.—1896.
- GRAU, PHILIP J.
Feed Water Purifier and Heater.—1886.
- GREENE, E. V.
Apparatus for Extracting Oil and Albuminoid from Corn.—1851.
- GRIMES, W. C.
Water Gauge for Steam Boilers.—1851.
- GRIMES, W. C.
Smut Machine.—1840.
- GRISWALD, GEORGE H., AND FULLER, FRED L.
Cash Register and Indicator.—1892.
- GROUPE, A. V.
Braiding Machine.—1900.
- GUILLAUME, C. E.
Invar Alloy.—1914.
- HADFIELD, ROBERT.
Manganese Steel.—1891.

- HAHL, A. L.
Pneumatic Clock.—1901.
- HAINES, ROBERT B., JR.
Automatic Micrometer Rolling Mill Plate Gauge.—1901.
- HAKEWESSEL, REINHOLD, AND HENN, EDWIN C.
Automatic Screw and Metal Working Machine.—1901.
- HALL, THOMAS.
Typewriter.—1884.
- HALL, M. W.
Duplex Steam Pump.—1886.
- HALLOCK, DAVID.
Weighing Scale.—1887.
- HALLOWELL, HOWARD T.
Pressed Steel Shaft Hangers.—1906.
- HAMMER, WILLIAM J.
Apparatus for Long Distance Phonographic and Telephonic Experiments.—1902.
- HANNAY, J. B., AND SHEDLOCK, ALFRED.
Lucigen.—1891.
- HANSON, HANS, AND HART, FREDERICK A.
Calculating and Typewriting Machine.—1915.
- HARDINGE, H. W.
Conical Pebble Mill.—1915.
- HARO, A LOPEX DE.
Electric Sea Compass; Automatic Electric Log Line.—1890.
- HART, EDWARD.
Acid Container.—1891.
- HART, FREDERICK A., AND HANSON, HANS.
Combined Calculating and Typewriting Machine.—1915.
- HART, WALTER.
Hoisting Machine.—1891.
- HEANY, J. A.
Enclosed Arc Lamp.—1904.
- HECTROTTE, A. G.
Car Couping.—1848.
- HELLINGS, J.
Mail Bag Fastener.—1890.
- HENN, E. C., AND HAKEWESSEL, REINHOLD.
Automatic Screw and Metal Working Machine.—1901.
- HERAEUS, W. C.
Fused Quartz Mercury Lamp.—1906.
- HERMAN, HENRY O.
Star Ventilator.—1902.
- HERR, H A.
Liquid Extraction Apparatus.—1909.
- HESS, G. A., CLAUD, G. M. A., FOCHE, E.
Process of Storing Explosive Gases.—1902.

- HEXAMER, C. J.
Apparatus for Preventing and Extinguishing Fires in Grinding Mills.—
1888.
- HEYL, HENRY R., AND BREHMER, HUGO.
Wire Book Sewing Machine.—1883.
- HEYL, HENRY R.
Wire Fastened Paper Boxes.—1875.
- HIGGINS, A., AND JACOBS, C. B.
Alundum Refractories.—1909.
- HILL, T.
Calculating Instrument.—1843.
- HOBSON, A. E.
Hydraulic Shaping Press.—1890.
- HOLCOMBE, A.
Reflecting Telescope.—1835.
- HOPKINS, EDWARD P.
Electric Arc Lamp.—1896.
- HOPKINS, N. M.
Pneumatic Water Pipe Cushioning.—1900.
- HOUGH, JAMES, AND LAUGHLIN, SAMUEL.
Drawing Tables.—1900.
- HUMPHREY, F. A.
Improved Sawing Machine and Guide.—1901.
- HUMPHREY, H. A., AND CERASOLI, ALBERTO.
Hydraulic Pump.—1914.
- HUTCHINS AND MARETT.
Tilting Chair.—1875.
- HYATT, I. S.
Purification of Water System.—1888.
- HYATT, J. W.
Roller Bearings.—1898.
- HILDER, J. D.; SMITH, A. C.; SUNDH, AUGUST; OTIS, SIDNEY.
Electric Elevator.—1902.
- IRWIN, JOHN H.
Lantern.—1873.
- IVES, FREDERICK E.
Isochromatic Photography.—1887.
- IVES, FREDERICK E.
Projecting Lantern and Appurtenances.—1890.
- IVES, FREDERICK E.
Parallax Stereogram.—1904.
- IVES, FREDERICK E.
New Form of Replica of Rowland Diffraction Grating.—1905.
- IVES, FREDERICK E.
Color Meter.—1907.

- JACKSON, WALTER W., AND CONNET, F. N.
Improved Venturi Meter.—1898.
- JACOBS, C. B., AND HIGGINS, A. C.
Alundum Refractories.—1909.
- JANDUS, WILLIAM.
Enclosed Arc Lamp.—1895.
- JAY, PERRIE EGMOND.
Automatic Anti-Freezing Valve.—1885.
- JENKINS, C. F.
Motion Pictures Apparatus.—1909.
- JENKS, W.
Fire Arms.—1840.
- JEWELL, M. R.; POWERS, T. B.; KELLY, J. F.
Teleelectric Piano Player.—1910.
- JOHNSON, A. L.
Bonding Joint for Electric Railways.—1896.
- JOHNSON, E. H.
Interior Electric House Conduit.—1891.
- JONES, ALFRED C.
Shaft Couplings.—1842.
- JONES, EVAN W.
Underfeed Mechanical Stoker.—1904.
- JONES, H. P.
Baling Machine.—1901.
- JONES, J. R.
Method of and Apparatus for Axle Rolling.—1892.
- KELLY, J. F.; POWERS, T. B.; JEWELL, M. R.
Teleelectric Piano Player.—1910.
- KEMBLE, B. H.
Wheel Hubs.—1883.
- KENT, A. ATWATER.
Ignition System for Automobiles.—1914.
- KITE, J. S.
Safety Beam.—1840.
- KNEASS, S. L.
Injector.—1901.
- KOYL, C. H.
Parabolic Semaphore.—1889.
- KURTZ, DAVID T.
Cap Screws and Bolts.—1905.
- LA RUE, S. H.
Stove for Soft or Bituminous Coal.—1893.
- LATTIG, J. W.
Automatic Electric Semaphore Signal.—1904.
- LAUGHLIN, SAMUEL, AND HOUGH, JAMES.
Drawing Tables.—1900.

- LECLERE, FRANCIS.
Black Printing Process.—1897.
- LECLERE, FRANCIS.
Toothed Gear Wheel.—1891.
- LEONARD, H. W.
System of Motor Control.—1902.
- LEVY, M. AND L. E.
Screens for Photo-Mechanical Engraving.—1897.
- LEWIS, WILFRED; TABOR, HARRIS; MUMFORD, E.
Molding Machine.—1902.
- LINCOLN, P. M.
Synchronism Indicator.—1902.
- LITTLE AND ELMER
Chronometer.—1837.
- LOSS, HENRIK V.
Solid Steel Railway Wheels Manufactured by Hydraulic Forging with Rolling.—1904.
- LOVEKIN, L. D.
Device for Relieving Forces due to Inertia and Weight of Valve Gears.—1910.
- LOWE, J.
Spinning Mule.—1890.
- LUNGREN, CHARLES M.
Incandescent Gas Light.—1892.
- MACCOY, J. S.
Pneumatic Tool.—1890.
- MCCALL, THOMAS A., AND PILLINGS, JOHN H.
Automatic Typewriter.—1917.
- MCCAULEY, THOMAS, AND REED, C. J.
Speed-Jack.—1907.
- MCCLELLAN, EZRA S.
Anti-Siphon Vent.—1892.
- MCCRACKEN, EDWIN D.
Insulated Electrical Conductors.—1896.
- MCINTIRE, C.
Electric Wire Connectors.—1890.
- McKEE, M. A.
Process of Treating Printing Plates.—1912.
- McKEMMIL, JOHN, AND DUNHAM, JOSEPH M.
Metallic Drawing Rolls.—1894.
- McMAHAN, J.
Stereotyping Plate.—1835.
- McMULLEN, JOHN.
Machine for Knitting Stockings.—1835.
- MACHLET, GEORGE, AND REICHELHM, E. P.
Apparatus for Producing Fuel Gas.—1894.

- MCCURDY, ARTHUR W.
Apparatus for Developing Photographic Roll Prints.—1904.
- MADDOX, R. L.
Substitution of Gelatine for Collodion in Photography.—1889.
- MAHAN, FRANCIS.
Measure Case Ruler.—1837.
- MARCY, L. J.
Magic Lantern.—1887.
- MARKS, A. A.
Artificial Limbs.—1889.
- MARSDEN, M.
Corn-pith Cellulose.—1896.
- MASON, A. J.
Washer Punching Machine.—1891.
- MELLOR, L. B.
Device for Measuring and Recording the Variable Diameter of Tubes.—1903.
- MERGENTHALER, O.
Linotype.—1889.
- MERKET, LUZERNE, AND THOMAS, ALMER.
Tempered Copper.—1891.
- MERRICK AND TOWNE.
Boring Machine.—1840.
- MERSHON, R. D.
Compensated Potential Indicator.—1901.
- METZLER, CHRISTIAN E., AND BURRELL, JOHN H.
Railway Signal Lantern.—1885.
- MEYERS, J. G.
Mausoleum.—1889.
- MEYLAN, EUGENE, AND RECKNIEWSKI, CAMILLE S.
Electric Meter.—1893.
- MILLER, D. K.
Self Locking Padlock.—1883.
- MILLIAU, EDWARD.
Apparatus for Analyzing Fats and Oils.—1896.
- MOFFETT, GEORGE, AND DOBBINS, EDWARD J.
Light Projecting Glass.—1901.
- MOORE, D. MCFARLAN.
Vacuum-tube Light.—1909.
- MOORE, LEE C.
Wire Testing Machine.—1904.
- MORRIS, HENRY G., AND SALOM, PEDRO G.
Electric Automobile.—1897.
- MORSE, EVERETT F.
Heat Gage.—1903.
- MORSE, EVERETT F.
Drive Chains.—1901.

McGraw, H. J. C.

Complementary Color Designs and Crystal Patterns.—1894.

McNair, J. W.

Behmenhof Glassware.—1896.

McNair, J. W.

Lighting.—1899.

McNair, J. W.

Methods and Process for Manufacturing Mosaics.—1898.

McNair, J. W. and Tabor, H.

Lighting.—1896.

McNair, J. W.

Lighting.—1883.

McNair, J. W.

Methods for Railroad Curves.—1842.

McNair, J. W.

Methods.—1896.

McNair, J. W. and Tabor, H.

Methods for Rail-Bonding.—1906.

McNair, J. W.

Methods.—1840.

McNair, J. W.

Methods.—1895.

McNair, J. W.

Methods for Metal Pipes.—1875.

McNair, J. W.; Hilder, J. D.; Sundh, August.

McNair, J. W.

Methods for Fabricating Fabrics and Castings Therefrom.—1888.

McNair, J. W.

Methods for Investigating the Molecular Physics of Cast Iron.—1897.

McNair, J. W. and Blondel, Andre.

McNair, J. W.

Methods.—1898.

McNair, J. W.

Methods.—1840.

McNair, J. W.

Methods.—Reynolds, J. R.; Tirrell, J. P.

Methods and Speed Limit System.—1900.

McNair, J. W.

Methods.—1847.

McNair, J. W.

Methods.—1895.

McNair, J. W.

Methods.—1895.

McNair, J. W.

Methods.—Potterton, J. G.; Carny, T.; Cook, H.

McNair, J. W.

- PATTERSON, J. G.; PATTERSON, H. G.; CARNEY, T.; COOK, H.
Cash Registers.—1901.
- PAYEN, C.
Chloride Electrical Storage Battery.—1894.
- PEALE, F.
Coining Presses at the United States Mint, Philadelphia.—1840.
- PENTZ, A. D.
Boring and Milling Engine.—1891.
- PERRY, N. W.
Method of Series Electric Traction.—1894.
- PFATISCHER, MATTHIAS.
Variable Speed Motors.—1909.
- PHELPS, L. J.
Induction Telegraph.—1886.
- PHOENIX IRON COMPANY.
Automatic Cut-Off Steam Engine.—1886.
- PILLINGS, JOHN H., AND MCCALL, THOMAS A.
Automatic Typewriter.—1917.
- PONTRICHET, J.
"Heliographic" Paper.—1894.
- POOLE AND COMPANY, J. MORTON.
Grinding Metallic Calendar Rolls.—1875.
- POWERS, T. B.; JEWELL, M. R.; KELLY, J. F.
Teleelectric Piano Player.—1910.
- PRATT AND WHITNEY COMPANY.
Taps and Gauges.—1883.
- PRATT AND WHITNEY COMPANY.
System of Interchangeable Cut Gears.—1886.
- PRENTISS, H. S.
Automatic Calendar.—1896.
- PRIESTMAN, W. D. AND SAMUEL.
Steam Engine.—1894.
- PRUNTY, JOHN E.
Relief Valve.—1875.
- PRUTZMAN, A.
Door Lock.—1836.
- REAGAN, J.
Grate Bars.—1908.
- RECEVEUR, P. N.
Rose Engine (Lathe).—1853.
- RECKNIEWSKI, CAMILLE, AND MEYLAN, EUGENE.
Electric Meter.—1893.
- REDDAWAY, FRANK.
Camel Hair Belting.—1898.
- REED, CHARLES J., AND MCCAULEY, THOMAS.
Speed-Jack.—1906.

REICHHELM, E. P., AND MACHLET, GEORGE.

Apparatus for Producing Fuel Gases.—1894.

RENO, J. W.

Escalator.—1916.

REYNOLDS, J. R., PALMER, FREDERICK, S.; TIRRELL, J. P.

Engine Stop and Speed Limit System.—1906.

RHODES, J.

Map for the Blind.—1906.

RHODES, J.

System for Illumination.—1896.

RHODES, J.

System for Testing Certain Metal Alloys.—1901.

RHODES, J.

System for Illumination.—1896.

RHODES, J.

System for Illumination.—1896.

RHODES, J.

System for Illumination.—1896.

RHODES, J.

System for Illumination.—1896.

RHODES, J.

System for Illumination.—1896.

RHODES, J.

System for Illumination.—1896.

RHODES, J.

System for Illumination.—1896.

RHODES, J.

System for Illumination.—1896.

RHODES, J.

System for Illumination.—1896.

RHODES, J.

System for Illumination.—1896.

RHODES, J.

System for Illumination.—1896.

RHODES, J.

System for Illumination.—1896.

RHODES, J.

System for Illumination.—1896.

RHODES, J.

System for Illumination.—1896.

RHODES, J.

System for Illumination.—1896.

RHODES, J.

System for Illumination.—1896.

RHODES, J.

System for Illumination.—1896.

RHODES, J.

System for Illumination.—1896.

- SAYEN, H. L.
Improved Roentgen Ray Tubes.—1898.
- SAXTON, J.
Reflecting Pyrometer.—1842.
- SHELLENBACH, WILLIAM S.
System of Gearing.—1902.
- SCHMIDT, M. E.
Moving Platform.—1906.
- SCHOOP, MAX ULRICH.
Metal Spraying Process.—1917.
- SEE, H.
Hydro-Pneumatic Ash Ejector.—1904.
- SEMPLE, J. B.
Shell Torch or Tracer.—1905.
- SENNEFF, JACOB.
Eye-Harness for Metallic Heddle.—1853.
- SEVERY, M. L.
Printing Machine.—1898.
- SEYMOUR, C.
Balancer for Pulleys, Fly Wheels, etc.—1878.
- SEXTON, A.
Slide Rule.—1899.
- SHAW, T.
Instrument for Testing Ignitable Gases in Mines.—1889.
- SHAW, THOMAS.
Gunpowder Pile Driver.—1872.
- SHAW, THOMAS.
Spiral Exhaust Nozzle.—1877.
- SHAW, THOMAS.
Friction Buffer.—1883.
- SHAY, EPHRAIM.
Geared Locomotive.—1892.
- SHEDLOCK, ALFRED, AND HANNAY, J. B.
Lamp for Engineering Uses.—1891.
- SHIMER, P. W.
Combustion Crucible.—1901.
- SHOLES, C. LATHAM; GLIDDENS, CARLOS; SOULE, SAMUEL W.
Typewriter.—1875.
- SHORE, A. F.
Scleroscope.—1909.
- SHUMAN, F. S.
Wired Glass.—1894.
- SHUMAN, F.
Concrete Pile for Foundations.—1904.
- SMITH, R. C.; OTIS, SIDNEY; IHLDER, J. D.; SUNDH, AUGUST.
Electric Elevator.—1902.
- SOULE, SAMUEL W.; GLIDDENS, CARLOS; SHOLES, C. LATHAM.
Typewriter.—1875.

- SPEIDEL, J. G.**
Hoisting Machines.—1891.
- SPELLER, L. H.**
Electric Clock.—1887.
- SPENCER, J. E., AND FIELD, D. W.**
Damper Regulator.—1893.
- SPERRY, E. A.**
Gyroscope Compass.—1914.
- SPIELMAN, A.**
Cloth Cutting Machine.—1914.
- SPIRO, C.**
Barlock Typewriter.—1894.
- SPRATT, ORLANDS W.**
Mercury Seal Trap.—1885.
- SPRINGER, ALFRED, AND ROEDER, F. A.**
Torsion Balance.—1891.
- SQUIER, G. O., AND CREHORE, A.**
Polarizing Photo-Chronograph.—1896.
- STACKHOUSE, THOMAS H.**
Diagraph.—1895.
- STAHLBERG, C.**
Time Dating Stamp.—1891.
- STARR, J. E.; BRANSON, DAVID; THORNBURGH, R. D.; FULLER, J. E.**
Refrigeration Process.—1894.
- STEINBART, ALFRED, AND UEHLING, EDWARD.**
Pneumatic Pyrometer.—1898.
- STEINBART, ALFRED, AND UEHLING, EDWARD.**
Gas Composimeter.—1899.
- STELLWAGON, H. S.**
Sounding Apparatus.—1848.
- STIERINGER, L.**
Improved Method of Electric Illumination.—1902.
- STREET, CLEMENT F.**
Locomotive Stoker.—1915.
- STECKLAND, W.**
Substitution of Lime for Salt for Preserving Lumber.—1840.
- SUGER, AUGUST; OTIS, SIDNEY; SMITH, A. C.; IHLDER, J. D.**
Electric Elevator.—1902.
- SWEETLAND, ERNEST J.**
Paper Press.—1913.
- SWEETLAND, ERNEST J.**
Round Lay Baling Cotton Compress.—1900.
- TALL, HENRY; LAY, A. WALTER; MUMFORD, E.**
Sounding Machine.—1912.
- TAYLOR, JAMES; AND BALL, CHESTER, A.**
Apparatus for Baling Cotton.—1900.

- TALBOT, E.
Improved Methods in the Manufacture of Steel.—1908.
- TATHAM, B., AND BRITTIN, J. W.
Safety Catch for Elevators.—1875.
- TATTERSALL, ALFRED R.
Flour Mill.—1917.
- TAYLOR, C. M., JR.
Absorption Process for Butter Making.—1903.
- TEAL, C. A.
Portable Hoist.—1889.
- THOMAS, ALMER, AND MERKET, LUZERNE.
Tempered Copper.—1891.
- THOMSON, ELIHU.
Electric Welding.—1889.
- THOMSON, ELIHU.
Constant Current Arc Light Transformer.—1901.
- THORNBURGH, R. D.; STARR, J. E.; BRANSON, DAVID; FULLER, J. E.
Refrigeration Process.—1894.
- THUM, CHARLES D.
Varnish Brushes.—1854.
- TIRRILL, A. A.
Voltage Regulator.—1910.
- TIRRELL, J. P.; REYNOLDS, J. R.; PALMER, F. S.
Engine Stop and Speed Limit System.—1906.
- TOWNSEND, ISAAC.
Tent Fastening.—1885.
- TWEDDELL, R. H.
Method of Applying Hydraulic Power to Mechanical Work.—1894.
- TYLER, PHILOS B.
Shifting Gauge Cock for Steam Boilers.—1835.
- TYSON, CHARLES.
Machine to Unite Uppers to the Soles of Shoes.—1875.
- UEHLING, EDWARD, AND STEINBART, ALFRED.
Gas Composimeter.—1899.
- UEHLING, EDWARD, AND STEINBART, ALFRED.
Pneumatic Pyrometer.—1898.
- VAN KANNEL, T.
Storm Door.—1890.
- VAUCLAIN, SAMUEL M.
Truck Wheel Centres.—1891.
- VILLEROI, M.
Telescope.—1849.
- VOYNOW, C. B., AND NICHOLS, H. B.
Cast Zinc Joint for Rail Bonding.—1904.
- WAHL, J. C., AND GOLDBERG, H. E.
Adding Machine.—1916.

- WAIT, W. B.
Machine for Tangible Writing for Touch Reading.—1900.
- WALE, GEORGE AND COMPANY.
Projection Lantern.—1875.
- WALSH, E. M. AND SYDNEY B.
Method of Making Large Objects from Pieces of Aventurine.—1902.
- WALSH, SYDNEY B. AND E. M.
Method of Making Large Objects from Pieces of Aventurine.—1902.
- WALTER, L. H.
Method of Detecting Electrical Oscillations.—1907.
- WALTER, B.
Electric Switch.—1905.
- WEBSTER, W. R.
Apparatus for Observing the Relations between the Chemical Constitution and Ultimate Strength of Steel.—1897.
- WEHNELT, A.
Interrupter for Induction Machines.—1905.
- WELIN, A.
Life Saving Appliances on Board Ship.—1910.
- WESTINGHOUSE, GEORGE, JR.
Railway Car Brake.—1874.
- WETZEL, F. J.
Automatic Mechanical Stoker.—1909.
- WHARTON, WILLIAM, JR.
Safety Railway Switch.—1873.
- WHEELER, S. S.
Electric Fan.—1904.
- WHITALL, HENRY.
Planisphere.—1883.
- WHITE, O. C.
Adjustable Extension Movement in Ball and Socket Joints.—1889.
- WIEDIG, H. P.
Chemical Fire Extinguisher.—1894.
- WIGMORE, WILLIAM H., AND DOERR, JOHN H.
Sleeping Car.—1885.
- WILKIN, J. T.
System of Generating and Forming Cycloidal Surfaces.—1894.
- WILCOX, CHARLES H., AND CARLETON, CYRUS.
Automatic Tension and Improved Sewing Machines.—1875.
- WILLANS, P. W.
Steam Engine.—1895.
- WILLIAMS, C. D.
Revolving Show Window.—1892.
- WILLIAMS, JOHN N.
Typewriting Machine.—1897.
- WILLMUNDER, H.
Swivel Loom.—1898.

WILLS, SAMUEL.

Journal Bearing and Car Axle-Box.—1885.

WINSLOW, S. E.

Pivot Scale Beam.—1840.

WIRT, CHARLES.

Rheostat.—1902.

WOOD, R. W.

Diffraction Color Photography.—1907.

WOOD, THOMAS.

Fountain Pen.—1839.

WOODBURY, C. J. H.

Electric Light Main Testing Apparatus.—1884.

WOODRUFF, W. N.

System of Keying for Machinery.—1888.

WOOTEN, J. E.

Locomotive and Boiler.—1890.

WURTZ, A. J.

Lightning Arrestors and Non-Arcing Metal.—1894.

YARYAN, H. T.

System of Evaporation in Vacuo.—1886.

YEOMANS, LUCIEN I.

Method of Machine Construction.—1917.

ZIEGLER, G. W.

Trestles and Scaffolding.—1888.

TERMS AND PRIVILEGES OF MEMBERSHIP

The members of the Institute are divided into the following classes, viz.: *Resident Members, Stockholders, Life Members, Permanent Members, Non-resident and Associate Members.*

Any one interested in the purposes and objects of the Institute and expressing a willingness to further the same may become a member when proposed by a member in good standing and elected by the Board of Managers.

Terms.—Resident members pay Fifteen Dollars each year. The payment of Two Hundred Dollars in any one year secures Life Membership, with exemption from annual dues.

Stock.—Second-class stockholders pay an annual tax of Twelve Dollars per share, and the holder of one share is entitled by such payment to the privileges of membership.

Privileges.—Each contributing member (including non-residents) and adult holder of second-class stock is entitled to participate in the meetings of the Institute, to use the Library and Reading Room, to vote at the Annual Election for officers, to receive tickets to the lectures for himself and friend, to attend the Section meetings and to receive one copy of the JOURNAL free of charge except associate members, who may not take part in elections.

Permanent Members.—The Board of Managers may grant to any one who shall in any one year contribute to the Institute the sum of One Thousand Dollars a permanent membership, transferable by will or otherwise.

Non-resident Members.—Newly elected members residing permanently at a distance of twenty-five miles or more from Philadelphia may be elected as non-resident members, and are required to pay an entrance fee of Five Dollars and Five Dollars annually. Non-resident Life Members pay no dues.

Resident members, if eligible, under the non-resident clause, on reaching twenty-five miles may be transferred to the non-resident class by vote of the Board of Managers, and are required to pay Five Dollars annually.

Associate Members.—Associate members are accorded all the privileges of the Institute except the right to vote or hold office, upon the payment of dues of Five Dollars. This class of membership is limited to persons under the age of nineteen and twenty-five years. Upon reaching twenty-five years of age they become eligible to the other classes of membership.

Transactions must be made in writing, and dues must be paid to the date of publication.

MEMBERSHIP DIRECTORY.

HONORARY MEMBERS.

- Brigadier General JAMES ALLEN, U.S.A. (Retired), Army and Navy Club, Washington, D. C.
Colonel GEORGE L. ANDERSON, U.S.A. (Retired),
Prof. SVANTE AUGUST ARRHENIUS, Nobel Institute, Stockholm, Sweden.
Colonel JOHN J. CARTY, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
Prof. CHARLES F. CHANDLER, Columbia University, New York City, New York.
Sir JAMES DEWAR, The Royal Institution, London, W. 1., England.
Mr. THOMAS A. EDISON, Orange, New Jersey.
Prof. CHARLES FABRY, Professor of Physics, University of Paris, 1 Rue Victor-Cousin, Paris (5e), France.
Prof. GEORGE FORBES, No. 11 Little College Street, Westminster, S. W., London, England.
Prof. HENDRIK A. LORENTZ, Zylweg 76, Haarlem, Holland.
Senator GUGLIELMO MARCONI, Royal Italian Senate, Rome, Italy.
Dr. T. C. MENDENHALL, Ravenna, Ohio.
Rear Admiral JOSEPH B. MURDOCK, U.S.N. (Retired), Danbury, New Hampshire.
Prof. HEIKE KAMERLINGH ONNES, University of Leiden, Leiden, Holland.
Hon. Sir CHARLES A. PARSONS, 6 Windsor Terrace, Newcastle-On-Tyne, England.
General JOHN J. PERSHING, War Department, Washington, D. C.
Mr. RALPH W. POPE, 570 Cherry Street, Elizabeth, New Jersey.
Prof. THEODORE WILLIAM RICHARDS, Wolcott Gibbs Memorial Laboratory, Harvard University, Cambridge, Massachusetts.
Mr. FRANK J. SPRAGUE, Consulting Engineer, President, Sprague Safety Control & Signal Corporation, 421 Canal Street, New York City, New York.
Major-General GEORGE OWEN SQUIER, War Department, Washington, D. C.
Rear Admiral DAVID WATSON TAYLOR, Bureau of Construction and Repair, Navy Department, Washington, D. C.
Prof. WILLIAM CAWTHORNE UNWIN, Palace Gate Mansions, Kensington, London, England.
Dr. H. W. WILEY, Room 1120, Woodward Building, Washington, D. C.
Lieutenant A. B. WYCKOFF, U.S.N. (Retired), 131 East H Street, Ontario, California.

CORRESPONDING MEMBERS.

- Professor A. S. EVE, McGill University, Montreal, Canada.
Mr. T. COMMERFORD MARTIN, 29 West 39th Street, New York City, New York.
Prof. JOHN SEALY TOWNSEND, New College, Oxford, England.

IN MEMORIAM.

- Mr. ISAAC B. THORN.

MEMBERS.

- ABBOTT, ROBERT R., Metallurgical Engineer, The Peerless Motor Car Company, Cleveland, Ohio.
ACHESON, Dr. EDWARD G., Manufacturer, Acheson Corporation, Æolian Building, 35 West 42nd Street, New York City, New York.
ADAMS, HOWARD L., Managing Director, Keystone Institute, Reading, Pennsylvania.
ADAMS, MERRITT H., Works Manager, Vim Motor Company, 23rd & Market Streets, Philadelphia, Pennsylvania.
ADDICKS, WALTER R., Vice President, Consolidated Gas Company of New York, 130 E. 15th Street, New York City, New York.
ADRIANO, FELIPE T., Industrial Chemist, Malolos, Bulakan, Philippine Islands.
ADSIT, CHARLES G., Engineer, 555 Electric and Gas Building, Atlanta, Georgia.
AKELEY, CARL E., Taxidermist and Sculptor, American Museum of Natural History, 77th Street and Central Park West, New York City, New York.

- MORSELL, W. F. C.
Complementary Color Designs and Crystal Patterns.—1894.
- MOSER, L.
"Bohemian" Glassware.—1886.
- MOSKOWITZ, MORRIS.
System of Car Lighting.—1900.
- MUELLER, H. C.
Apparatus and Process for Manufacturing Mosaics.—1898.
- MUMFORD, EDGAR; LEWIS, WILFRED; TABOR, H.
Molding Machine.—1902.
- NACKE, ARNOLD.
Screw Cutting Attachment.—1883.
- NAGLEE, H. M.
Flat Bar or Edge Rail for Railroad Curves.—1842.
- NERNST LAMP COMPANY.
Incandescent Lamp.—1906.
- NICHOLS, H. B., AND VOYNOW, C. B.
Cast Zinc Joint for Rail-Bonding.—1906.
- OLDS, CALVIN.
Planting Machine.—1840.
- ORUM, MORRIS L.
Improved Lock.—1885.
- ORUM, MORRIS L.
Mandrel for Bending Metal Pipes.—1875.
- OTIS, SIDNEY; SMITH, R. C.; IHLDER, J. D.; SUNDH, AUGUST.
Electric Elevator.—1902.
- OUTERBRIDGE, A. E., JR.
Method of Carbonizing Fabrics and Castings Therefrom.—1888.
- OUTERBRIDGE, A. E., JR.
Method for Investigating the Molecular Physics of Cast Iron.—1897.
- PAAROWDAKI, SPIRIDION, AND BLONDEL, ANDRE.
Holophone Globes.—1898.
- PALMER, B. F.
Artificial Leg.—1849.
- PALMER, FREDERICK; REYNOLDS, J. R.; TIRRELL, J. P.
Engine Stop and Speed Limit System.—1906.
- PARKER, ZEBULON.
Water Wheel.—1847.
- PARKINSON, EDWARD.
Knitting Machine.—1905.
- PARSONS, L. H.
Scale Measure.—1852.
- PATTERSON, H. G.; PATTERSON, J. G.; CARNEY, T.; COOK, H.
Cash Registers.—1901.

- PATTERSON, J. G.; PATTERSON, H. G.; CARNEY, T.; COOK, H.
Cash Registers.—1901.
- PAYEN, C.
Chloride Electrical Storage Battery.—1894.
- PEALE, F.
Coining Presses at the United States Mint, Philadelphia.—1840.
- PENTZ, A. D.
Boring and Milling Engine.—1891.
- PERRY, N. W.
Method of Series Electric Traction.—1894.
- PFATISCHER, MATTHIAS.
Variable Speed Motors.—1909.
- PHELPS, L. J.
Induction Telegraph.—1886.
- PHOENIX IRON COMPANY.
Automatic Cut-Off Steam Engine.—1886.
- PILLINGS, JOHN H., AND MCCALL, THOMAS A.
Automatic Typewriter.—1917.
- PONTRICHET, J.
"Heliographic" Paper.—1894.
- POOLE AND COMPANY, J. MORTON.
Grinding Metallic Calendar Rolls.—1875.
- POWERS, T. B.; JEWELL, M. R.; KELLY, J. F.
Teleelectric Piano Player.—1910.
- PRATT AND WHITNEY COMPANY.
Taps and Gauges.—1883.
- PRATT AND WHITNEY COMPANY.
System of Interchangeable Cut Gears.—1886.
- PRENTISS, H. S.
Automatic Calendar.—1896.
- PRIESTMAN, W. D. AND SAMUEL.
Steam Engine.—1894.
- PRUNTY, JOHN E.
Relief Valve.—1875.
- PRUTZMAN, A.
Door Lock.—1836.
- REAGAN, J.
Grate Bars.—1908.
- RECEVEUR, P. N.
Rose Engine (Lathe).—1853.
- RECKNIEWSKI, CAMILLE, AND MEYLAN, EUGENE.
Electric Meter.—1893.
- REDDAWAY, FRANK.
Camel Hair Belting.—1898.
- REED, CHARLES J., AND MCCAULEY, THOMAS.
Speed-Jack.—1906.

- REICHHHELM, E. P., AND MACHLET, GEORGE.
Apparatus for Producing Fuel Gases.—1894.
- RENO, J. W.
Escalator.—1910.
- REYNOLDS, J. R.; PALMER, FREDERICK, S.; TIRRELL, J. P.
Engine Stop and Speed Limit System.—1906.
- RHOADS, J.
Map for the Blind.—1840.
- RICHARDS, J.
Solder for Aluminum.—1896.
- RICHARDS, J.
Balance for Testing White Metal Alloys.—1901.
- RICHARDS, T. A.
Ruling Machine.—1890.
- RICHARDSON.
Eccentric Door Spring.—1840.
- RICHARDSON, J. H.
Signal Lantern.—1868.
- RIDGWAY, T. S., JR.
Transit Theodolite.—1839.
- RIDGWAY, W. H.
Balanced Crane.—1890.
- RIEFLER, SIGMUND.
Mercurial Compensation Pendulum.—1894.
- RITCHIE, E. S.
Improved Rhumkorff Coil.—1860.
- RITES, F. M.
Perfecting of Shaft Governor System.—1902.
- ROEDER, F. A., AND SPRINGER, ALFRED.
Torsion Balance.—1891.
- RONDINELLA, L. F.
Photo-Printing Machine.—1905.
- ROOT, J. B.
Spiral Weld Tubing.—1890.
- ROOTS, P. H. AND F. M.
Rotary Pressure Blower.—1875.
- RORER, T. J.
Belting.—1875.
- ROSENBAUM, WALTER A.
Automatic Hydraulic Letter Copying Press.—1905.
- SACHS, J.
Enclosed Fuse Protective Devices.—1903.
- SALOM, PEDRO G., AND MORRIS, HENRY G.
Electric Automobile.—1897.
- SARGENT, C. E.
Expansion Gas Engine.—1907.

- SAYEN, H. L.
Improved Roentgen Ray Tubes.—1898.
- SAXTON, J.
Reflecting Pyrometer.—1842.
- SCHELLENBACH, WILLIAM S.
System of Gearing.—1902.
- SCHMIDT, M. E.
Moving Platform.—1906.
- SCHOOP, MAX ULRICH.
Metal Spraying Process.—1917.
- SEE, H.
Hydro-Pneumatic Ash Ejector.—1904.
- SEMPLE, J. B.
Shell Torch or Tracer.—1905.
- SENNEFF, JACOB.
Eye-Harness for Metallic Heddle.—1853.
- SEVERY, M. L.
Printing Machine.—1898.
- SEYMOUR, C.
Balancer for Pulleys, Fly Wheels, etc.—1878.
- SEXTON, A.
Slide Rule.—1899.
- SHAW, T.
Instrument for Testing Ignitable Gases in Mines.—1889.
- SHAW, THOMAS.
Gunpowder Pile Driver.—1872.
- SHAW, THOMAS.
Spiral Exhaust Nozzle.—1877.
- SHAW, THOMAS.
Friction Buffer.—1883.
- SHAY, EPHRAIM.
Geared Locomotive.—1892.
- SHEDLOCK, ALFRED, AND HANNAY, J. B.
Lamp for Engineering Uses.—1891.
- SHIMER, P. W.
Combustion Crucible.—1901.
- SHOLES, C. LATHAM; GLIDDENS, CARLOS; SOULE, SAMUEL W.
Typewriter.—1875.
- SHORE, A. F.
Scleroscope.—1909.
- SHUMAN, F. S.
Wired Glass.—1894.
- SHUMAN, F.
Concrete Pile for Foundations.—1904.
- SMITH, R. C.; OTIS, SIDNEY; IHLDER, J. D.; SUNDH, AUGUST.
Electric Elevator.—1902.
- SOULE, SAMUEL W.; GLIDDENS, CARLOS; SHOLES, C. LATHAM.
Typewriter.—1875.

- SPEIDEL, J. G.
Hoisting Machines.—1891.
- SPELLIER, L. H.
Electric Clock.—1887.
- SPENCER, J. E., AND FIELD, D. W.
Damper Regulator.—1893.
- SPERRY, E. A.
Gyroscope Compass.—1914.
- SPIELMAN, A.
Cloth Cutting Machine.—1914.
- SPIRO, C.
Barlock Typewriter.—1894.
- SPRATT, ORLANDS W.
Mercury Seal Trap.—1885.
- SPRINGER, ALFRED, AND ROEDER, F. A.
Torsion Balance.—1891.
- SQUIER, G. O., AND CREHORE, A.
Polarizing Photo-Chronograph.—1896.
- STACKHOUSE, THOMAS H.
Diagraph.—1895.
- STAHLBERG, C.
Time Dating Stamp.—1891.
- STARR, J. E.; BRANSON, DAVID; THORNBURGH, R. D.; FULLER, J. E.
Refrigeration Process.—1894.
- STEINBART, ALFRED, AND UEHLING, EDWARD.
Pneumatic Pyrometer.—1898.
- STEINBART, ALFRED, AND UEHLING, EDWARD.
Gas Composimeter.—1899.
- STELLWAGON, H. S.
Sounding Apparatus.—1848.
- STIERINGER, L.
Improved Method of Electric Illumination.—1902.
- STREET, CLEMENT F.
Locomotive Stoker.—1915.
- STRICKLAND, W.
Substitution of Lime for Salt for Preserving Lumber.—1840.
- SUNDH, AUGUST; OTIS, SIDNEY; SMITH, A. C.; IHLDER, J. D.
Electric Elevator.—1902.
- SWEETLAND, ERNEST J.
Filter Press—1918.
- SWENSON, MAGNUS.
Round Lap Baling Cotton Compress.—1900.
- TABER, HARRIS; LEWIS, WILFRED; MUMFORD, E.
Molding Machines.—1902.
- TAINTER, SUMMER, AND BELL, CHICHESTER, A.
Apparatus for Recording Sound.—1900.

- TALBOT, E.
Improved Methods in the Manufacture of Steel.—1908.
- TATHAM, B., AND BRITTIN, J. W.
Safety Catch for Elevators.—1875.
- TATTERSALL, ALFRED R.
Flour Mill.—1917.
- TAYLOR, C. M., JR.
Absorption Process for Butter Making.—1903.
- TEAL, C. A.
Portable Hoist.—1889.
- THOMAS, ALMER, AND MERKET, LUZERNE.
Tempered Copper.—1891.
- THOMSON, ELIHU.
Electric Welding.—1889.
- THOMSON, ELIHU.
Constant Current Arc Light Transformer.—1901.
- THORNBURGH, R. D.; STARR, J. E.; BRANSON, DAVID; FULLER, J. E.
Refrigeration Process.—1894.
- THUM, CHARLES D.
Varnish Brushes.—1854.
- TIRRILL, A. A.
Voltage Regulator.—1910.
- TIRRELL, J. P.; REYNOLDS, J. R.; PALMER, F. S.
Engine Stop and Speed Limit System.—1906.
- TOWNSEND, ISAAC.
Tent Fastening.—1885.
- TWEDDELL, R. H.
Method of Applying Hydraulic Power to Mechanical Work.—1894.
- TYLER, PHILOS B.
Shifting Gauge Cock for Steam Boilers.—1835.
- TYSON, CHARLES.
Machine to Unite Uppers to the Soles of Shoes.—1875.
- UEHLING, EDWARD, AND STEINBART, ALFRED.
Gas Composimeter.—1899.
- UEHLING, EDWARD, AND STEINBART, ALFRED.
Pneumatic Pyrometer.—1898.
- VAN KANNEL, T.
Storm Door.—1890.
- VAUCLAIN, SAMUEL M.
Truck Wheel Centres.—1891.
- VILLEROI, M.
Telescope.—1849.
- VOYNOW, C. B., AND NICHOLS, H. B.
Cast Zinc Joint for Rail Bonding.—1904.
- WAHL, J. C., AND GOLDBERG, H. E.
Adding Machine.—1916.

- WAIT, W. B.
Machine for Tangible Writing for Touch Reading.—1900.
- WALE, GEORGE AND COMPANY.
Projection Lantern.—1875.
- WALSH, E. M. AND SYDNEY B.
Method of Making Large Objects from Pieces of Aventurine.—1902.
- WALSH, SYDNEY B. AND E. M.
Method of Making Large Objects from Pieces of Aventurine.—1902.
- WALTER, L. H.
Method of Detecting Electrical Oscillations.—1907.
- WALTER, B.
Electric Switch.—1905.
- WEBSTER, W. R.
Apparatus for Observing the Relations between the Chemical Constitution and Ultimate Strength of Steel.—1897.
- WEHNELT, A.
Interrupter for Induction Machines.—1905.
- WELIN, A.
Life Saving Appliances on Board Ship.—1910.
- WESTINGHOUSE, GEORGE, JR.
Railway Car Brake.—1874.
- WETZEL, F. J.
Automatic Mechanical Stoker.—1909.
- WHARTON, WILLIAM, JR.
Safety Railway Switch.—1873.
- WHEELER, S. S.
Electric Fan.—1904.
- WHITALL, HENRY.
Planisphere.—1883.
- WHITE, O. C.
Adjustable Extension Movement in Ball and Socket Joints.—1889.
- WIEDIG, H. P.
Chemical Fire Extinguisher.—1894.
- WIGMORE, WILLIAM H., AND DOERR, JOHN H.
Sleeping Car.—1885.
- WILKIN, J. T.
System of Generating and Forming Cycloidal Surfaces.—1894.
- WILCOX, CHARLES H., AND CARLETON, CYRUS.
Automatic Tension and Improved Sewing Machines.—1875.
- WILLANS, P. W.
Steam Engine.—1895.
- WILLIAMS, C. D.
Revolving Show Window.—1892.
- WILLIAMS, JOHN N.
Typewriting Machine.—1897.
- WILLMUNDER, H.
Swivel Loom.—1898.

WILLS, SAMUEL.

Journal Bearing and Car Axle-Box.—1885.

WINSLOW, S. E.

Pivot Scale Beam.—1840.

WIRT, CHARLES.

Rheostat.—1902.

WOOD, R. W.

Diffraction Color Photography.—1907.

WOOD, THOMAS.

Fountain Pen.—1839.

WOODBURY, C. J. H.

Electric Light Main Testing Apparatus.—1884.

WOODRUFF, W. N.

System of Keying for Machinery.—1888.

WOOTEN, J. E.

Locomotive and Boiler.—1890.

WURTZ, A. J.

Lightning Arrestors and Non-Arcing Metal.—1894.

YARYAN, H. T.

System of Evaporation in Vacuo.—1886.

YEOMANS, LUCIEN I.

Method of Machine Construction.—1917.

ZIEGLER, G. W.

Trestles and Scaffolding.—1888.

TERMS AND PRIVILEGES OF MEMBERSHIP

The members of the Institute are divided into the following classes, viz.: *Resident Members, Stockholders, Life Members, Permanent Members, Non-resident and Associate Members.*

Any one interested in the purposes and objects of the Institute and expressing a willingness to further the same may become a member when proposed by a member in good standing and elected by the Board of Managers.

Terms.—Resident members pay Fifteen Dollars each year. The payment of Two Hundred Dollars in any one year secures Life Membership, with exemption from annual dues.

Stock.—Second-class stockholders pay an annual tax of Twelve Dollars per share, and the holder of one share is entitled by such payment to the privileges of membership.

Privileges.—Each contributing member (including non-residents) and adult holder of second-class stock is entitled to participate in the meetings of the Institute, to use the Library and Reading Room, to vote at the Annual Election for officers, to receive tickets to the lectures for himself and friend, to attend the Section meetings and to receive one copy of the JOURNAL free of charge, except associate members, who may not take part in elections.

Permanent Members.—The Board of Managers may grant to any one who shall in any one year contribute to the Institute the sum of One Thousand Dollars a permanent membership, transferable by will or otherwise.

Non-resident Members.—Newly elected members residing permanently at a distance of twenty-five miles or more from Philadelphia may be enrolled as Non-resident Members, and are required to pay an entrance fee of Five Dollars, and Five Dollars annually. Non-resident Life Membership, \$75.00.

Contributing members, if eligible, under the non-resident clause, on making request therefor, may be transferred to the non-resident class by vote of the Board of Managers, and are required to pay Five Dollars annually.

Associate Members.—Associate members are accorded all the privileges of the Institute, except the right to vote or hold office, upon the payment of annual dues of Five Dollars. This class of membership is limited to persons between the ages of seventeen and twenty-five years. Upon reaching the age limit they become eligible to the other classes of membership.

Resignations must be made in writing, and dues must be paid to the date of resignation.

MEMBERSHIP DIRECTORY.

HONORARY MEMBERS.

- Brigadier General JAMES ALLEN, U.S.A. (Retired), Army and Navy Club, Washington, D. C.
Colonel GEORGE L. ANDERSON, U.S.A. (Retired),
Prof. SVANTE AUGUST ARRHENIUS, Nobel Institute, Stockholm, Sweden.
Colonel JOHN J. CARTY, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
Prof. CHARLES F. CHANDLER, Columbia University, New York City, New York.
Sir JAMES DEWAR, The Royal Institution, London, W. 1., England.
Mr. THOMAS A. EDISON, Orange, New Jersey.
Prof. CHARLES FABRY, Professor of Physics, University of Paris, 1 Rue Victor-Cousin, Paris (5e), France.
Prof. GEORGE FORBES, No. 11 Little College Street, Westminster, S. W., London, England.
Prof. HENDRIK A. LORENTZ, Zylweg 76, Haarlem, Holland.
Senator GUGLIELMO MARCONI, Royal Italian Senate, Rome, Italy.
Dr. T. C. MENDENHALL, Ravenna, Ohio.
Rear Admiral JOSEPH B. MURDOCK, U.S.N. (Retired), Danbury, New Hampshire.
Prof. HEIKE KAMERLINGH ONNES, University of Leiden, Leiden, Holland.
Hon. Sir CHARLES A. PARSONS, 6 Windsor Terrace, Newcastle-On-Tyne, England.
General JOHN J. PERSHING, War Department, Washington, D. C.
Mr. RALPH W. POPE, 570 Cherry Street, Elizabeth, New Jersey.
Prof. THEODORE WILLIAM RICHARDS, Wolcott Gibbs Memorial Laboratory, Harvard University, Cambridge, Massachusetts.
Mr. FRANK J. SPRAGUE, Consulting Engineer, President, Sprague Safety Control & Signal Corporation, 421 Canal Street, New York City, New York.
Major-General GEORGE OWEN SQUIER, War Department, Washington, D. C.
Rear Admiral DAVID WATSON TAYLOR, Bureau of Construction and Repair, Navy Department, Washington, D. C.
Prof. WILLIAM CAWTHORNE UNWIN, Palace Gate Mansions, Kensington, London, England.
Dr. H. W. WILEY, Room 1120, Woodward Building, Washington, D. C.
Lieutenant A. B. WYCKOFF, U.S.N. (Retired), 131 East H Street, Ontario, California.

CORRESPONDING MEMBERS.

- Professor A. S. EVE, McGill University, Montreal, Canada.
Mr. T. COMMERFORD MARTIN, 29 West 39th Street, New York City, New York.
Prof. JOHN SEALY TOWNSEND, New College, Oxford, England.

IN MEMORIAM.

- Mr. ISAAC B. THORN.

MEMBERS.

- ABBOTT, ROBERT R., Metallurgical Engineer, The Peerless Motor Car Company, Cleveland, Ohio.
ACHESON, Dr. EDWARD G., Manufacturer, Acheson Corporation, Æolian Building, 35 West 42nd Street, New York City, New York.
ADAMS, HOWARD L., Managing Director, Keystone Institute, Reading, Pennsylvania.
ADAMS, MERRITT H., Works Manager, Vim Motor Company, 23rd & Market Streets, Philadelphia, Pennsylvania.
ADDICKS, WALTER R., Vice President, Consolidated Gas Company of New York, 130 E. 15th Street, New York City, New York.
ADRIANO, FELIPE T., Industrial Chemist, Malolos, Bulakan, Philippine Islands.
ADSIT, CHARLES G., Engineer, 555 Electric and Gas Building, Atlanta, Georgia.
AKELEY, CARL E., Taxidermist and Sculptor, American Museum of Natural History, 77th Street and Central Park West, New York City, New York.

- AKIMOFF, NICHOLAS W.**, Mechanical and Hydraulic Engineer, 1013 Harrison Building, Philadelphia, Pennsylvania.
- ALBRECHT, A. C.**, Vice President, North Brothers Manufacturing Company, Lehigh Avenue and American Street, Philadelphia, Pennsylvania.
- ALLAN, ANDREW, JR.**, Manufacturer of Bearing Metals, Harrison, New Jersey.
- ALLEMAN, GELLERT**, Professor of Chemistry, Swarthmore College, and for mail, 8 Whittier Place, Swarthmore, Pennsylvania.
- ALLEN, HENRY B.**, Metallurgical Engineer, 8112 St. Martins Lane, Chestnut Hill, Philadelphia, Pennsylvania.
- ALLEN, JAMES**, Brigadier General, U.S.A., Army and Navy Club, Washington, D. C.
- ALLEN, WILLIAM E.**, Clerk, 109 S. 43rd Street, Philadelphia, Pennsylvania.
- ALLEN, WILLIAM W.**, Retired Chemical Manufacturer, 557 Church Lane, Germantown, Philadelphia, Pennsylvania.
- ALSBERG, Dr. CARL L.**, Stanford University, California.
- AMES, Dr. JOSEPH S.**, Director Physical Laboratory, The John Hopkins University, Baltimore, Maryland.
- ANDERSON, OLAF**, Geologist, Mineralogical Institute, Kristiania, Norway.
- ANDERSON FRANK**, Mining Engineer, 468 12th-East Street, Salt Lake City, Utah.
- ANDERSON, Colonel GEORGE L.**, U.S.A., Electrical Engineer, Address unknown.
- ANDERSON, ROBERT J.**, Metallurgical Engineer, U.S. Bureau of Mines, Experiment Station, Pittsburgh, Pennsylvania.
- ANDREAU, ROLAND L.**, Laurel Springs, New Jersey.
- ANDREWS, W. S.**, Consulting Electrical Engineer, General Electric Company, Schenectady, New York.
- ANGERER, VICTOR**, Vice-President, Taylor-Wharton Iron and Steel Company, P. O. Box 162, Ridley Park, Pennsylvania.
- APPELBAUM, ALAN I.**, Chemist, P. O. Box 808, Trenton, New Jersey.
- ARMSTRONG, WILLIAM R.**, Clerk, Powers-Weightman-Rosengarten Company, Philadelphia, Pennsylvania.
- ARRHENIUS, SVANTE AUGUST**, Physicist, Nobel Institute, Stockholm, Sweden.
- ARNY, H. V.**, Professor of Chemistry, 115 West 68th Street, New York City, New York.
- ASEF, Dr. WALDEMAR**, Research Chemist, Research Department, Pennsylvania Salt Manufacturing Company, Greenwich Point, Philadelphia, Pennsylvania.
- ASHBROOK, Dr. DONALD S.**, Chemist, 2404 Willard Street, Wilmington, Delaware.
- ASHHURST, JOHN**, Librarian, The Free Library of Philadelphia, 13th and Locust Streets, Philadelphia, Pennsylvania.
- ASHMEAD, FRANK M.**, Civil Engineer, 816 Ivy Street, Pittsburgh, Pennsylvania.
- ATLEE, JOSHUA W.**, Naval Architect, William Cramp and Son's Ship and Engine Building Company, and for mail, Riverton, New Jersey.
- ATLEE, WALTER**, Civil Engineer, Box 173, Beckley, West Virginia.
- ATTERBURY, W. W.**, Vice President, Pennsylvania Railroad Company, Broad Street Station, Philadelphia, Pennsylvania.
- ATWATER, RICHARD M. Jr.**, Consulting Mining Engineer, Scarsdale, New York.
- AUSTIN, Dr. LOUIS W.**, U. S. Naval Radio Research Laboratory, Bureau of Standards, Washington, D.C.
- AUSTIN, W. L.**, Vice Chairman of the Board, The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- AYRES, EUGENE, E.**, Sharples Specialty Company, West Chester, Pennsylvania.
- BACHE, DANIEL T.**, Student, 2102 Pine Street, Philadelphia, Pennsylvania.
- BACON, Dr. RAYMOND FOSS**, Chemist Director, Mellon Institute of Industrial Research, University of Pittsburgh, Pittsburgh, Pennsylvania.
- BAEKELAND, Dr. L. H.**, Research Chemist, Snug Rock, Harmony Park, Yonkers-on-Hudson, New York.
- BAKER, FRANKLIN, JR.**, Manufacturer, Wayne Avenue and Hortter Street, Germantown, Philadelphia, Pennsylvania.
- BAKER, GEORGE FALES**, Physician, 403 Lafayette Building, Philadelphia, Pennsylvania.
- BALCH, ALFRED C.**, Publisher, 227 South 6th Street, Philadelphia, Pennsylvania.
- BALCH, EDWIN S.**, Attorney-at-Law, 1634 Spruce Street, Philadelphia, Pennsylvania.
- BALDWIN, A. STUART**, Chief Engineer, Illinois Central Railroad Company, Chicago, Illinois.
- BALDWIN, FREDERIC E.**, (Retired), 2200 Walnut Street, Philadelphia, Pennsylvania.
- BALLARD, JUDSON T.**, Chemist, 1010 Chelton Avenue, Oak Lane, Philadelphia, Pennsylvania.
- BALLARD, R. H.**, Vice President and Assistant General Manager, Southern California Edison Company, Edison Building, Los Angeles, California.
- BALLENTINE, WILLIAM I.**, Vice President, Advance Rumely Company, La Porte, Indiana.
- BALLINGER, WALTER F.**, Architect, Twelfth and Chestnut Streets, Philadelphia, Pennsylvania.

- BANCROFT, JOHN**, Manufacturer, Wilmington, Delaware.
- BANCROFT, JOSEPH**, Vice President and Treasurer, Joseph Bancroft and Sons, Wilmington, Delaware.
- BANNISTER, J. C.**, Lock Box 26, Boston, Massachusetts.
- BARNES, JAMES**, Professor of Physics, Bryn Mawr College, Bryn Mawr, Pennsylvania.
- BARNES, JOHN HAMPTON**, Attorney-at-Law, Morris Building, 1421 Chestnut Street Philadelphia, Pennsylvania.
- BARNETT, EDWIN S.**, Wheat Starch Manufacturer, 7011 Cresheim Road, Mt. Airy, Philadelphia, Pennsylvania.
- BARNHART, G. EDWARD**, Aeronautical Engineer, 191 Marion Avenue, Pasadena, California.
- BARR, JOHN H.**, Mechanical Engineer, Remington Typewriter Company, 374 Broadway, New York City, New York.
- BARRINGER, DANIEL MOREAU**, Geologist and Mining Engineer, 1242 Real Estate Trust Building, Philadelphia, Pennsylvania.
- BARTH, CARL G.**, Consulting Engineer, Room 216, 10 South 18th Street, Philadelphia, Pennsylvania.
- BARTLESON, T. LEES**, Chemist, E. I. du Pont de Nemours and Company, and for mail, 305 W. 19th Street, Wilmington, Delaware.
- BARTOW, EDWARD**, Chemistry Department, State University of Iowa, Iowa City, Iowa.
- BARWIS, CALVIN W.**, Civil Engineer, in care of Pennsylvania Railroad Company, Warren, Pennsylvania.
- BASFORD, G. M.**, President, Locomotive Feed Water Heater Company, Room 719, 17 East 42nd Street, New York City, New York.
- BASHORE, E. GORGAS**, Consulting Chemical Engineer, Rice & Bashore, Highland Building Pittsburgh, Pennsylvania.
- BASKERVILLE, DR. CHARLES**, Director of Laboratories, Department of Chemistry, College of the City of New York, New York City, New York.
- BASSETT, WILLIAM H.**, Technical Superintendent, American Brass Company, Waterbury, Connecticut, and for mail, Cheshire, Connecticut.
- BATES, ONWARD**, Civil Engineer, 332 South Michigan Avenue, Chicago, Illinois.
- BEACH, CHARLES S.**, Designer and Machinist, 745 Main Street, Bennington, Vermont.
- BEALE, HORACE A., JR.**, President, Parkesburg Iron Company, Parkesburg, Pennsylvania.
- BEALE, LEONARD T.**, Secretary, John T. Lewis & Brother Company, 705 Lafayette Building, Philadelphia, Pennsylvania.
- BEATH, E. R.**, Lapidist and Jeweler, 129 South 12th Street, Philadelphia, Pennsylvania.
- BECK, M. A.**, Vice President and Chief Engineer, Milwaukee Electric Crane and Manufacturing Company, 294 Greenbush Street, Milwaukee, Wisconsin.
- BECKER, IRWIN A.**, Pharmacist, in care of Michael Reese Hospital, 2839 Ellis Avenue, Chicago, Illinois.
- BELFIELD, T. BROOM**, Manufacturer, 1905 Spring Garden Street, Philadelphia, Pennsylvania.
- BELL, J. SNOWDEN**, Attorney-at-Law, P. O. Box 629, City Hall Station, New York City, New York.
- BEMENT, CLARENCE S.**, 3907 Spruce Street, Philadelphia, Pa.
- BEMENT, WILLIAM P.**, (Retired), 743 Real Estate Trust Building, Philadelphia, Pennsylvania.
- BENNETT, FREDERICK M.**, Mechanical and Electrical Engineer, 2516 Harlan Street, Philadelphia, Pennsylvania.
- BENZON, GEORGE H., JR.**, Mechanical Engineer, 252 Mather Road, Jenkintown, Pennsylvania.
- BERG, ERNST J.**, Professor of Electrical Engineering, Union College, Schenectady, New York.
- BERG, HOLGER V.**, Chemical Engineer, Newport, Delaware.
- BERLINER, EMILE**, Engineer, 1458 Columbia Road, Washington, D. C.
- BERLINER, HERBERT S.**, Engineer, in care of Berliner Gramophone Company, Montreal, Canada.
- BERRSFORD, A. W.**, General Manager, The Cutler-Hammer Manufacturing Company, Milwaukee, Wisconsin.
- BEST, W. N.**, President, W. N. Best Incorporated, Engineers in Caloric, 11 Broadway, New York City, New York.
- BIDDLE, CHARLES M., JR.**, First Vice President, Supplee-Biddle Hardware Company, 517 Commerce Street, Philadelphia, Pennsylvania.
- BIDDLE, ELIZABETH C.**, 400 South 15th Street, Philadelphia, Pennsylvania.
- BIDDLE, H. W.**, Stock Broker, 424 Chestnut Street, Philadelphia, Pennsylvania.

- BIDDLE, JAMES G.**, Importer of Scientific Apparatus, Wallingford, Pennsylvania.
- BIDDLE, ROBERT**, President, Biddle-Gaumer Company, 3846-56 Lancaster Avenue, Philadelphia, Pennsylvania.
- BIERBAUM, CHRISTOPHER H.**, Consulting Engineer, 1011 Mutual Life Building, Buffalo, New York.
- BIGELOW, S. LAWRENCE**, Professor of General and Physical Chemistry, University of Michigan, Ann Arbor, Michigan.
- BILGRAM, HUGO**, Machinist, 1235 Spring Garden Street, Philadelphia, Pennsylvania.
- BILLINGS, Lieutenant Commander, A. W. K.**, Civil, Mechanical and Electrical Engineer, Apartado 570, Barcelona, Spain.
- BILLOW, CLAYTON O.**, Consulting Engineer, 6800 Sheridan Road, Chicago, Illinois.
- BILYEU, THOMAS**, Mechanical Engineer, 697 E. Broadway Street, Portland, Oregon.
- BINDER, RICHARD L.**, President, K. & B. Company, Special Electrical Supplies, 931 North 8th Street, Philadelphia, Pennsylvania.
- BINNS, ARTHUR W.**, Steam Engineer, 1929 Poplar Street, Philadelphia, Pennsylvania.
- BIRCH, GEORGE W., JR.**, Chemist, 1414 East Columbia Avenue, Philadelphia, Pennsylvania.
- BIRKINBINE, CARL PETER**, Engineer, Room 800, Commercial Trust Building, Philadelphia, Pennsylvania.
- BLACKBURN, ARTHUR**, Grain Merchant, 315 Chamber of Commerce, and for mail, 5905 York Road, Baltimore Maryland.
- BLACKBURN, CAROLINE D.**, Chemist, 207 South 39th Street, Philadelphia, Pennsylvania.
- BLAIR, A. A.**, Analytical Chemist, 406 Locust Street, Philadelphia, Pennsylvania.
- BLAKELEY, ABRAHAM G.**, Chief Chemist, Philadelphia and Reading Coal and Iron Company, Pottsville, Pennsylvania.
- BLATZ, FREDERICK J.**, Leather Manufacturer, P. O. Box 967, Wilmington, Delaware.
- BLUM, ARTHUR N.**, Mechanical Engineer, Delmar-Morris Apartments, Germantown, Philadelphia, Pennsylvania.
- BODINE, SAMUEL T.**, President, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- BOEHMKE, Dr. RODRICH**, Manufacturing Optician, 827 Spring Garden Street, Philadelphia, Pennsylvania.
- BOEKEL, J.**, Manufacturer of Metal Goods, 518 Vine Street, Philadelphia, Pennsylvania.
- BOERICKE, FELIX A.** (Retired), Bryn Athyn, Pennsylvania.
- BOERICKE, GIDEON**, Civil Engineer, Wynnewood, Pennsylvania.
- BOERICKE, JOHN J.**, Metallurgist, Secretary, Primos Chemical Company, and for mail, Merion, Pennsylvania.
- BONINE, CHARLES E.**, Consulting and Designing Engineer, Franklin Trust Building, 20 South 15th Street, Philadelphia, Pennsylvania.
- BOOZ, H. C.**, Chief Engineer, Berwind-White Coal Mining Company, 1100 Commercial Trust Building, Philadelphia, Pennsylvania.
- BORGNER, CYRUS**, Manufacturer of Fire Brick and Clay Retorts, 234 North 23rd Street, Philadelphia, Pennsylvania.
- BORIE, BEAUVEAU, JR.**, Investment Broker, 511 Chestnut Street, Philadelphia, Pennsylvania.
- BORTON, GEORGE W.**, President and General Manager, Pennsylvania Crusher Company, 1324 Stephen Girard Building, Philadelphia, Pennsylvania.
- BOSTWICK, J. VAUGHAN**, 426 Montgomery Avenue, Haverford, Pennsylvania.
- BOURNE, GEORGE L.**, Vice President, Locomotive Superheater Company, 30 Church Street, New York City, New York.
- BOWEN, SAMUEL B.**, Manufacturer, 4th Street and Sedgley Avenue, Philadelphia, Pennsylvania.
- BOWER, C. P.**, Civil Engineer, 403 Westview Avenue, Philadelphia, Pennsylvania.
- BOWER, WILLIAM HENRY**, Manufacturing Chemist, 29th Street and Grays Ferry Road, Philadelphia, Pennsylvania.
- BRADBURY, Dr. ROBERT H.**, Science Teacher, Southern High School, 2100 Shunk Street, Philadelphia, Pennsylvania.
- BRADDOCK-ROGERS, K.**, 125 West Park Avenue, Haddonfield, New Jersey.
- BRADLEY, A. J.**, Manufacturer, 101 Beekman Street, New York City, New York.
- BRADLEY, FRANCIS**, Engineer, Midvale Steel Company, P. O. Box 1606, Philadelphia, Pennsylvania.
- BRADSHAW, HAMILTON**, Chemist, Director, Experimental Station, E. I. du Pont de Nemours & Company, Henry Clay, Delaware.
- BRADSHAW, WILLIAM HENRY**, Chemist, 1241 Carpenter Street, Philadelphia, Pennsylvania.
- BRADY, EDWARD**, Engineering Research, 3101 Passyunk Avenue, Philadelphia, Pennsylvania.

- BREED, GEORGE**, Consulting Engineer, 277 Harvey Street, Germantown, Philadelphia, Pennsylvania.
- BREWER, Dr. J. EDWARD**, Chemist, 215 Summit Street, Norristown, Pennsylvania.
- BREWSTER, FRANK H.**, General Superintendent, United States Rubber Reclaiming Works, 180 Woodbridge Avenue, Buffalo, New York.
- BRIESEN, FRITZ V.**, Attorney-at-Law, 25 Broad Street, New York City, New York.
- BRIMMER, F. E.**, Chemical Manufacturer, Hydrocarbon Chemical Company, Lancaster, Pennsylvania.
- BRINLEY, CHARLES E.**, President, American Pulley Company, 4200 Wissahickon Avenue, Philadelphia, Pennsylvania.
- BRINTON, RUSSELL L.**, Carol Boulevard, Highland Park, Delaware County, Pennsylvania.
- BRINTON, WILLIAM C., JR.**, Chief Engineer, Philbrin Corporation, Kennett Square, Pennsylvania.
- BROCK, JOHN W.** Retired Attorney, 511 Bullitt Building, Philadelphia, Pennsylvania.
- BROMLEY, JOSEPH H.**, Manufacturer, Chelten and Wissahickon Avenues, Philadelphia, Pennsylvania.
- BROWN, FRANCIS SHUNK**, Lawyer, 1005 Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- BROWN, J. STANFORD**, P. O. Box 38, Black Hall, Connecticut.
- BROWN, KENNETH R.**, Chemist, Atlas Club, Tamaqua, Pennsylvania.
- BROWN, LUCIUS P.**, Chemist, Franklin, Tennessee.
- BROWN, RICHARD P.**, President, Brown Instrument Company, Wayne and Windrim Avenues, Philadelphia, Pennsylvania.
- BROWNSTEIN, BENJAMIN**, Mechanical Engineer, Elwood City, Pennsylvania.
- BRUNEL, ROGER F.**, Professor of Chemistry, Bryn Mawr College, Bryn Mawr, Pennsylvania.
- BRUNNER, FRANK A.**, Drawing Materials, 910 Filbert Street, Philadelphia, Pennsylvania.
- BRUNKER, ROBERT J.**, Banker, 1000 Walnut Street, Philadelphia, Pennsylvania.
- BRUSH, CHARLES F.**, Electrical Engineer, 3725 Euclid Avenue, Cleveland, Ohio.
- BUCHANAN, CHARLES GORDON**, Mechanical Engineer, 167 North Munn Avenue, East Orange, New Jersey.
- BUCK, H. W.**, Consulting Engineer, 49 Wall Street, New York City, New York.
- BUDD, A. VAN WYCK**, Berwyn, Prince George County, Maryland.
- BUDD, EDWARD G.**, Machinist, 502 Westview Street, Germantown, Philadelphia, Pennsylvania.
- BULLITT, JOHN C., 3rd**, 1811 Walnut Street, Philadelphia, Pennsylvania.
- BULLOCK, WILLIAM E.**, Mechanical Engineer, 29 West 39th Street, New York City, New York.
- BUMCKE, Dr. GEBHARDT**, Chemist, in care of National Oil Products Company, Essex and First Streets, Harrison, New Jersey.
- BUNNELL, STERLING H.**, Consulting Mechanical Engineer, 103 Park Avenue, New York City, New York.
- BUREAU, E. W.**, Bronze Founder, S. E. Corner 23rd and Westmoreland Streets, Philadelphia, Pennsylvania.
- BURGESS, WILLIAM J.**, 940 South 55th Street, Philadelphia, Pennsylvania.
- BURHORN, EDWIN**, Engineer and Contractor, 938 Hudson Street, Hoboken, New Jersey.
- BURK, ALFRED E.**, Manufacturer, 925 North Third Street, Philadelphia, Pennsylvania.
- BURKE, M. D.**, R.F.D., No. 8, Ashland, Ohio.
- BURLINGAME, LUTHER D.**, Industrial Superintendent, Brown and Sharp Manufacturing Company, Providence, Rhode Island.
- BURNHAM, GEORGE, JR.**, (Retired), 1301 Morris Building, Philadelphia, Pennsylvania.
- BURROUGH, JOSEPH H.**, Attorney-at-Law, 664 Bullitt Building, Philadelphia, Pennsylvania.
- BURT, MILO C.**, Chemist, 636 Water Street, Bridgeport, Connecticut.
- BURTON, THOMAS L.**, Consulting Engineer, Westinghouse Air Brake Company, 165 Broadway, New York City, New York.
- BUSH, S. P.**, Manufacturer, The Buckeye Steel Castings Company, Columbus, Ohio.
- BUSSER, FRANK S.**, Attorney-at-Law, 926 Land Title Building, Philadelphia, Pennsylvania.
- BUTLER, CHARLES N.**, Attorney-at-Law and Solicitor of Patents, 1318 Land Title Building, Philadelphia, Pennsylvania.
- BUXTON, GEORGE E.**, Industrial Engineer, 322 King Street, Pottstown, Pennsylvania.
- BYERS, ISAAC W.**, (Retired), Iron River, Michigan.

- BYRD, JOHN, Metal Worker, 1422 Catherine Street, Philadelphia, Pennsylvania.
- BYRNES, FRANK, Clerk, 535 West Montgomery Avenue, Philadelphia, Pennsylvania.
- CABOT, GEORGE E., Middle Road, Montecito, Santa Barbara, California.
- CADWALDER, Major GOUVEAUX, Manufacturer, O.O.R.C., Fort Washington, Pennsylvania.
- CAIRD, JAMES M., Chemist and Bacteriologist, 271 River Street, Troy, New York.
- CALKINS, G. H., Manager, General Electric Company, Tenth Floor, Electric Building, Buffalo, New York.
- CALVERT, HAROLD, Electrical Engineer, Philadelphia Electric Company, 226 South 11th Street, Philadelphia, Pennsylvania.
- CAMERON, Dr. FRANK E., Consulting Chemist, in care of American Smelting and Refining Company, Salt Lake City, Utah.
- CANBY, WILLIAM W., Fruit Grower, Grants Pass, Oregon.
- CANFIELD, FREDERICK, A., Mining Engineer, Dover, New Jersey.
- CAPLES, MARTIN J., Vice President, Seaboard Airline Railway Company, and for mail, 701 Stockley Gardens, Norfolk, Virginia.
- CAPP, JOHN A., Mechanical Engineer, 62 Bedford Road, Schenectady, New York.
- CAPP, S. BUNKER, Capitalist, P. O. Box 2054, Philadelphia, Pennsylvania.
- CAPPS, W. L., Rear Admiral, U.S.N., Chief Constructor, Bureau of Construction and Repair, Navy Department, Washington, D. C.
- CARNELL, W. C., Chemist, Charles Lennig and Company, Inc., and for mail, 1141 Arrott Street, Frankford, Philadelphia, Pennsylvania.
- CARTER, EDWARD C., Consulting Engineer, 412 Greenwood Boulevard, Evanston, Illinois.
- CARTER, JOHN E., (Retired), 5356 Knox Street, Germantown, Philadelphia, Pennsylvania.
- CARTY, JOHN J., Vice President and Chief Engineer, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
- CASPARI, Dr. CHARLES E., Professor of Chemistry, 2108 Locust Street, St. Louis, Missouri.
- CASSELMAN, WILLIAM S., Attorney-at-Law, Secretary, West Jersey Title and Guarantee Company, and for mail, 317 Penn Street, Camden, New Jersey.
- CATHERWOOD, WILSON, Merchant, 1708 Walnut Street, Philadelphia, Pennsylvania.
- CHAFFEE, E. LEON, Assistant Professor of Physics, Cruft Laboratory, Cambridge, Massachusetts.
- CHAMBERLAIN, G. E., Engineer, 1650 East William Street, Decatur, Illinois.
- CHAMBERS, Dr. ARTHUR DOUGLAS, Chemical Engineer, E. I. du Pont de Nemours and Company, and for mail, R.F.D. 1, Edgemoor, Delaware.
- CHAMBERS, FRANCIS T., Attorney-at-Law, 605-608 New Stock Exchange Building, 1411 Walnut Street, Philadelphia, Pennsylvania.
- CHAMBERS, J. HOWARD, Chambers Brothers Company, Founders and Machinists, and for mail, 3839 Powelton Avenue, Philadelphia, Pennsylvania.
- CHANCE, Dr. EDWIN M., Consulting Chemist and Engineer, 10 Simpson Road, Ocean City, New Jersey.
- CHANCE, Dr. HENRY M., Mining Engineer and Geologist, 839 Drexel Building, Philadelphia, Pennsylvania.
- CHANDLER, CHARLES F., Emeritus Professor of Chemistry, Columbia University, New York City, New York.
- CHANDLER, T. P., Architect, 249 South 16th Street, Philadelphia, Pennsylvania.
- CHARLTON, RICHARD C., 5017 Franklin Street, Frankford, Philadelphia, Pennsylvania.
- CHILDS, ARTHUR E., President, Massachusetts Lighting Companies, 77 Franklin Street, Boston, Massachusetts.
- CHRISTIANSON, A., Chief Engineer, Standard Steel Car Company, and for mail, 198 West Pearl Street, Butler, Pennsylvania.
- CHURCH, ARTHUR L., Assistant to the President, The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- CLAGHORN, CLARENCE R., Mining Engineer, 584 Lexington Avenue, New York City, New York.
- CLAMER, F. J., (Retired), Collegeville, Montgomery County, Pennsylvania.
- CLAMER, G. H., Metallurgist and Chemist, First Vice President and Secretary, The Ajax Metal Company, Frankford Avenue and Richmond Street, Philadelphia, Pennsylvania.
- CLARK, A. WAYNE, Chemist, in care of Johnson and Johnson, New Brunswick, New Jersey.
- CLARK, BEAUVAIS, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, MISS DARTHELA, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, EDWARD B., Publisher, 61 Cedar Street, Chicago, Illinois.

- CLARK, EDWARD L.**, Chief Engineer, Commercial Truck Company, Hunting Park and Rising Sun Avenues, Philadelphia, Pennsylvania.
- CLARK, E. W.**, Banker, 321 Chestnut Street, Philadelphia, Pennsylvania.
- CLARK, FRANK H.**, Consulting Engineer and Technical Advisor, Ministry of Communications Peking, China.
- CLARK, FRANK SHAW**, Mechanical Engineer, Stone and Webster Engineering Corporation, 147 Milk Street, Boston, Massachusetts.
- CLARK, JOSEPH S.**, Attorney-at-Law, Highland Avenue, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, THEOBALD F.**, 2300 Pine Street, Philadelphia, Pennsylvania.
- CLARK, WALTON**, Engineer, Vice President, The United Gas Improvement Company, and for mail, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, MRS. WALTON**, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, WALTON, JR.**, Attorney-at-Law, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLEMENT, F. H.**, Contractor, Land Title Building, Philadelphia, Pennsylvania.
- CLOUD, JOHN W.**, Chairman, The Westinghouse Brake & Saxby Signal Company, 82 York Road, King's Cross, London, N. I., England.
- CLYMER, EVAN MORGAN**, Chief Clerk, Inspector for Hull Material for U. S. Navy, and for mail, 142 East Fishers Avenue, Olney, Philadelphia, Pennsylvania.
- COATES, JESSE**, Consulting Engineer, and Metallurgist, 40 Ocean Avenue, Lynn, Massachusetts.
- COCHRAN, C. B.**, Chemist, State Dairy and Food Commission, and for mail, 514 South High Street, West Chester, Pennsylvania.
- COES, HAROLD V.**, Industrial Engineer, Room 1512, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- COFFIN, C. A.**, Chairman of the Board, General Electric Company, 120 Broadway, New York City, New York.
- COLBY, ALBERT LADD**, Consulting Engineer, 447 Brighton Street, Bethlehem, Pennsylvania.
- COLE, FRANCIS J.**, Chief Consulting Engineer, American Locomotive Company, and for mail, 3 Avon Road, Schenectady, New York.
- COLLINGWOOD, J. REED**, Buyer, Fels and Company, and for mail, 510 South 41st Street, Philadelphia, Pennsylvania.
- COLLINS, ARTHUR L.**, Test Engineer, 5616 Crowson Street, Germantown, Philadelphia, Pennsylvania.
- COLLINS, CHARLES RUSSELL**, Consulting Engineer, 805 Lowman Building, Seattle, Washington.
- COLLINS, HENRY H.**, Manufacturer, 226 Columbia Avenue, Philadelphia, Pennsylvania.
- COLLOM, SAMUEL H.**, President, Pennsylvania Flexible Metallic Tubing Company, 505 Abbott Building, Philadelphia, Pennsylvania.
- COLLY, A.**, Civil Engineer, P. O. Box 3583, Johannesburg, Transvaal, South Africa.
- COLTON, SABIN W., JR.** (Retired), Banker, Bryn Mawr, Pennsylvania.
- COLVIN, CHARLES H.**, Mechanical Engineer, 61 Poplar Street, Brooklyn, New York.
- COLVIN, FRED H.**, Editor and Mechanical Engineer, 56 North Maple Avenue, East Orange, New Jersey.
- COLVIN, HENRY FRED, 2nd**, Student, 56 North Maple Avenue, East Orange, New Jersey.
- COLWELL, ROBERT C.**, Professor of Physics, Geneva College, and for mail, 3101 College Avenue, Beaver Falls, Pennsylvania.
- COMEY, ARTHUR M.**, Director, Eastern Laboratory, E. I. du Pont de Nemours and Company, P. O. Drawer 424, Chester, Pennsylvania.
- CONAWAY, JOHN F.**, Secretary and Treasurer, National Umbrella Frame Company, 30th and Thompson Streets, Philadelphia, Pennsylvania.
- CONDICT, G. H.**, Consulting Mechanical and Electrical Engineer, 922 Central Avenue, Plainfield, New Jersey.
- CONN, CHARLES F.**, President, Giant Portland Cement Company, Pennsylvania Building, Philadelphia, Pennsylvania.
- CONNABLE, FRANK L.**, Vice President, E. I. du Pont de Nemours and Company, 622 du Pont Building, Wilmington, Delaware.
- CONRADSON, P. H.**, Chief Chemist, Galena Signal Oil Company, Franklin, Pennsylvania.
- CONVERSE, WILLIAM A.**, Chemical Engineer, Dearborn Chemical Company, McCormick Building, Chicago, Illinois.
- COOKE, MORRIS LLEWELLYN**, Consulting Engineer in Management, Acting Director, The Utilities Bureau, 1009 Finance Building, and for mail, 401 West Walnut Lane, Germantown, Philadelphia, Pennsylvania.

- COOLEY, MORTIMER E.**, Dean, Colleges of Engineering and Architecture, Engineering Building, University of Michigan, Ann Arbor, Michigan.
- COOPER, HENRY**, Manufacturer of Olive Oil, 403 East Valerio Street, Santa Barbara, California.
- COPE, THOMAS D.**, Assistant Professor of Physics, Randal Morgan Laboratory of Physics, University of Pennsylvania, Philadelphia, Pennsylvania.
- COPPAGE, BENJAMIN DENVER**, Experimental Engineer, E. I. du Pont de Nemours and Company, and for mail, 14 Willard Street, Wilmington, Delaware.
- COPPAGE, G. L.**, Assistant Works Manager, The Pusey and Jones Company, Wilmington, Delaware.
- COPPOCK, WALTER J.**, Instructor in Industry, Logan Hall, University of Pennsylvania, Philadelphia, Pennsylvania.
- CORNELIUS, CLARENCE E.**, Salesman, 222 West Hortter Street, Germantown, Philadelphia, Pennsylvania.
- CORNELIUS, JOHN C., JR.**, Architect, 420 West Price Street, Germantown, Philadelphia, Pennsylvania.
- CORNELIUS, JUSTICE C.**, Civil Engineer, 821 Lehigh Street, Easton, Pennsylvania.
- COSTELLO, PETER E.**, Real Estate and Contracting Builder, 3500 Diaston Street, Tacony, Philadelphia, Pennsylvania.
- COSTER, EDWARD L.**, Literary Mechanical Engineer, Katonah, New York.
- COTTRELL, JAMES W.**, Dealer in Automobiles, P. O. Box 302, Hammonton, New Jersey.
- COWAN, HENRY B.**, District Engineer, 502 North 39th Street, Philadelphia, Pennsylvania.
- COWAN, WILLIAM ARTHUR**, Assistant Chief Chemist, National Lead Company, 129 York Street, Brooklyn, New York.
- COWLES, ALFRED H.**, President, Electric Smelting and Aluminum Company, Sewaren, New Jersey.
- COX, J. D.**, President, Cleveland Twist Drill Company, Cleveland, Ohio.
- COX, JOHN L.**, Mechanical Engineer, 12 Summit Street, Chestnut Hill, Philadelphia, Pennsylvania.
- COX, WALTER**, President, Pennsylvania Wire Glass Company, Pennsylvania Building, Philadelphia, Pennsylvania.
- CRAGO, WILLIAM H.**, Civil Engineer, in care of Fajardo Sugar Company, Fajardo, Porto Rico.
- CRAMP, THEODORE W.**, Ship Builder, 816 Commercial Trust Building, Philadelphia, Pennsylvania.
- CRAMPTON, GEORGE S.**, Physician, 1700 Walnut Street, Philadelphia, Pennsylvania.
- CRAWFORD, D. F.**, General Manager, Pennsylvania Lines West of Pittsburgh, 5243 Ellsworth Avenue, Pittsburgh, Pennsylvania.
- CREIGHTON, H. JERMAIN**, Assistant Professor of Chemistry, Swarthmore College, Swarthmore, Pennsylvania.
- CRISFIELD, J. A. P.**, Mechanical Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- CROASDALE, JOHN P.**, Attorney-at-Law, 1011 Chestnut Street, Philadelphia, Pennsylvania.
- CROOK, ALFRED**, Vice President and General Manager, Philadelphia Roll and Machine Company, 25th Street and Washington Avenue, Philadelphia, Pennsylvania.
- CROW, E. Z.**, Chickasaw Shipbuilding & Car Company, P. O. Drawer 428, Chickasaw Branch, Mobile, Alabama.
- CROWELL, WALTER S.**, Chemical Engineer, Oak Lane, Philadelphia, Pennsylvania.
- CULLEN, GEORGE S.**, Insurance, 4504 Springfield Avenue, Philadelphia, Pennsylvania.
- CUMMINGS, J. H.**, President, John B. Stetson Company, Philadelphia, Pennsylvania.
- CUNNINGHAM, J. L.**, Superintendent of Motive Power, Pennsylvania Railroad Company, Pittsburgh, Pennsylvania.
- CURRAN, G. W.**, Secretary, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- CURTIS, CYRUS H. K.**, Curtis Publishing Building, Philadelphia, Pennsylvania.
- CURTISS, ELLIOTT**, Secretary and Treasurer, The United States Metallic Packing Company, 429 North 13th Street, Philadelphia, Pennsylvania.
- CURWEN, SAMUEL M.**, President, J. G. Brill Company, and for mail, Haverford, Pennsylvania.
- CUSHMAN, ALLERTON S.**, Director, The Institute of Industrial Research, 1845 B Street, N. W., Washington, D. C.
- CUYLER, THOMAS DE WITT**, Attorney-at-Law, Arcade Building, Philadelphia, Pennsylvania.
- DACOSTA, J. CHALMERS**, 3rd, Mechanical Engineer, 1529 Pine Street, Philadelphia, Pennsylvania.
- DAILY, FRANCIS X.**, Engineering Department, The Bell Telephone Company of Pennsylvania, and for mail, 14 Athens Avenue, Ardmore, Pennsylvania.

- DANNENBAUM, HERMAN N.**, Manufacturer, Vice President, National Ammonia Company, Frankford, Philadelphia, Pennsylvania.
- DASHIELL, B. J., JR.**, Consulting Engineer, Irvington, Baltimore, Maryland.
- DASHIELL, P. T.**, Assistant Engineer of Works, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- DAVIDS, R. W.**, Consulting Electrical Engineer, Merion Station, Pennsylvania.
- DAVIDSON, GEORGE M.**, Chemist and Engineer of Tests, C. & N. W. R. R., Company, Chicago, Illinois.
- DAVIS, CARLETON E.**, Civil Engineer, Chief, Bureau of Water, Room 790, City Hall, Philadelphia, Pennsylvania.
- DAVIS, CHARLES HENRY**, President and Trustee, Bass River, Cape Cod, Massachusetts.
- DAVIS, ERNEST H.**, Manager of Street Railways and Electric Light Plants, P. O. Box 424, Williamsport, Pennsylvania.
- DAVIS, W. W.**, Superintendent of Plants, Semet-Solvay Company, Syracuse, New York.
- DAWES, JAMES H.**, General Contractor, 3300 Arch Street, Philadelphia, Pennsylvania.
- DAY, Dr., ARTHUR L.**, Director Geophysical Laboratory Carnegie Institution, Washington, D. C.
- DAY, CHARLES**, Member of Firm, Day and Zimmerman, Engineers, 611 Chestnut Street, Philadelphia, Pennsylvania.
- DAY, DAVID T.**, Petroleum Expert, 715 19th Street, N. W., Washington, D. C.
- DAY, R. H.**, Steel Manufacturer, 419 North 2nd Street, Philadelphia, Pennsylvania.
- DELANO, FREDERIC A.**, Receiver, 288 Treasury Building, Washington, D. C.
- DELANY, PATRICK B.**, Electrical Engineer, Nantucket, Massachusetts.
- DELBRIDGE, THOMAS D.**, Chemist, Atlantic Refining Company, 3144 Passyunk Avenue, Philadelphia, Pennsylvania.
- DELENBAUGH, FREDERICK S., JR.**, Electrical Engineer, Massachusetts Institute of Technology, and for mail, 91 Spooner Road, Chestnut Hill, Massachusetts.
- DENIG FRED**, Student, 211 Whedbee Street, Fort Collins, Colorado.
- DESHONG, HOWARD T.**, Superintendent, Philadelphia Electric Company, and for mail, 9 Lansdowne Avenue, Lansdowne, Pennsylvania.
- DETWILER, J. G.**, Chemist, Room 913, The Texas Company, Houston, Texas.
- DEWAR, SIR JAMES**, Chemist, The Royal Institution, London, W. I., England.
- DICKERSON, EDWARD N.**, Attorney-at-Law, 41 Park Row, New York City, New York.
- DIDIER, PAUL**, Principal Assistant Engineer, Baltimore and Ohio Railroad Company, Conestoga Building, Wood and Water Streets, Pittsburgh, Pennsylvania.
- D'INVILLIERS, EDWARD VINCENT**, Geologist and Mining Engineer, 518 Walnut Street, Philadelphia, Pennsylvania.
- DISSTON, WILLIAM D.**, Manufacturer, in care of Henry Disston & Sons, Tacony, Philadelphia, Pennsylvania.
- DIVEN, J. M.**, Secretary, American Water Works Association, 153 West 71st Street, New York City, New York.
- DOANE, JOSEPH A.**, Chemist, Pennsylvania Salt Manufacturing Company, and for mail, 1243 Sedgley Avenue, Philadelphia, Pennsylvania.
- DOANE, SAMUEL E.**, Chief Engineer, National Lamp Works of the General Electric Company, Nela Park, Cleveland, Ohio.
- DODGE, KERN**, Consulting Engineer, The Dodge Steel Company, State Road and Hellerman Street, Tacony, Philadelphia, Pennsylvania.
- DOHERTY, HENRY L.**, President, Cities Service Company, 60 Wall Street, New York City, New York.
- DOLAN, THOMAS J.**, Chestnutwold Farm, Devon, Pennsylvania.
- DONALD, JAMES**, Naval Architect, Room 143, 17 Battery Place, New York City, New York.
- DONALD, WILLIAM**, Chemist and Assayer, Bloomingdale, New Jersey.
- DONNELLY, WILLIAM T.**, Consulting Engineer, Room 930, 17 Battery Place, New York City, New York.
- DONNER, WILLIAM H.**, Manufacturer, Morris Building, Philadelphia, Pennsylvania.
- DONOHUE, JOHN P.**, Coal Operator, Coulter Building, Greensburg, Pennsylvania.
- DORNER, WILLIAM F.**, 25th Ward Gas Works, Richmond and Tioga Streets, Philadelphia, Pennsylvania.
- DORR, JOHN V. N.**, Metallurgical and Chemical Engineer, President, The Dorr Company, Westport, Connecticut.
- DOUREDOURE, BERNARD L.**, Student, 103 Walnut Street, Philadelphia, Pennsylvania.
- DOUTHIRT, WALSTEIN, F.**, Vice President, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.

- DOW, HERBERT H.**, General Manager, The Dow Chemical Company, Midland, Michigan.
- DOYLE, WILLIAM J.**, Contractor and Builder, 1519 Sansom Street, Philadelphia, Pennsylvania.
- DRAKE, LEWIS MARVIN**, Experimental Scientist, West Fairview Avenue, Daytona, Florida.
- DREXEL, JOHN R.**, 112 Drexel Building, Philadelphia, Pennsylvania.
- DUBOSQUE, F. L.**, Superintendent of Floating Equipment, Pennsylvania Station, New York City, New York.
- DUNCAN, J. S.**, Inventor, 901 West Van Buren Street, Chicago, Illinois.
- DUNCAN, THOMAS**, President, Duncan Electric Manufacturing Company, Lafayette, Indiana.
- DUNDORE, CHARLES R.**, 8205 Seminole Avenue, Philadelphia, Pennsylvania.
- DUNN, GANO**, President, J. G. White Engineering Corporation, and for mail, 20 Washington Square, New York City, New York.
- DUNNINGTON, F. P.**, Professor of Chemistry, University of Virginia, Virginia.
- DUPONT, COLEMAN**, 808 Broome Street, Wilmington, Delaware.
- DUPONT, IRENEE**, Vice President, E. I. du Pont de Nemours and Company, Wilmington, Delaware.
- DUPONT, PIERRE S.**, President, E. I. du Pont de Nemours and Company, Wilmington, Delaware.
- DURBAN, THOMAS E.**, General Manager, Erie City Iron Works, Erie, Pennsylvania.
- EARNSHAW, WARNER G.**, Harrison Building, Philadelphia, Pennsylvania.
- EASON, JOHN STUART**, Vice President, Twin City Wringer Company, and for mail, 819 University Avenue, Minneapolis, Minnesota.
- EAVERSON, HOWARD N.**, Engineer, 4311 Bayard Street, Pittsburgh, Pennsylvania.
- EEBRL, E. G.**, Editor, Journal of the American Pharmaceutical Association, Room 253, Bourse Building, Philadelphia, Pennsylvania.
- EBERT, MORRIS**, Importer, 1706 Green Street, Philadelphia, Pennsylvania.
- ECKERT, SAMUEL B.**, Oil Refiner, Finance Building, 1428 South Penn Square, Philadelphia, Pennsylvania.
- ECKHARDT, E. A.**, Physicist, Bureau of Standards, Washington D. C.
- EDGAR, C. L.**, President and General Manager, Edison Electric Illuminating Company, 70 State Street, Boston, Massachusetts.
- EDISON, THOMAS A.**, Inventor, Orange, New Jersey.
- EDWARDS, JOHN R.**, Rear Admiral, U.S.N., 620 Hope Street, Bristol, Rhode Island.
- EGLIN, W. C. L.**, Vice President and Chief Engineer, Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- EHRET, CORNELIUS D.**, Patent Lawyer, 6911 Clearview Street, Mount Airy, Philadelphia, Pennsylvania.
- EISENLOHR, LOUIS H.**, Vice President, Otto Eisenlohr and Brothers, Inc., 932 Market Street, Philadelphia, Pennsylvania.
- ELDRED, BRYON E.**, President, Commercial Research Company, and for mail, 66 Myrtle Avenue, Flushing, Long Island, New York.
- ELDRIDGE, THOMAS E.**, Physician, 1811 North Logan Square, Philadelphia, Pennsylvania.
- ELKINS, GEORGE W.**, Vice President of Companies, Land Title Building, Philadelphia, Pennsylvania.
- ELKINTON, HOWARD W.**, Assistant Manager, Foreign Department, Philadelphia Quartz Company, 121 South Third Street, Philadelphia, Pennsylvania.
- ELKINTON, THOMAS W.**, Philadelphia Quartz Company, 121 South Third Street, Philadelphia, Pennsylvania.
- ELLIOT, Captain A. H.**, 30 Church Street, New York City, New York.
- ELLIOT, EDWIN**, Foundry Superintendent, 403 West Price Street, Germantown, Philadelphia, Pennsylvania.
- ELLIOTT, Captain HENRY M.**, 352 State Street, Albany, New York.
- ELLIS, CARLETON**, Industrial Research Chemist and Chemical Engineer, 92 Greenwood Avenue, Montclair, New Jersey.
- ELLIS, HALCOLM**, Mechanical Engineer, Fabrique Nationale d'Armes de Guerre, Herstal-les Liege, Belgium.
- ELMENDORF, ARMIN**, Consulting Engineer, Haskelite Manufacturing Corporation, 819 Chamber of Commerce Building, Chicago, Illinois.
- ELVERSON, JAMES, JR.**, Publisher, The Philadelphia Inquirer, Philadelphia, Pennsylvania.
- EMERSON, GEORGE H.**, Chief of Motive Power and Equipment, Baltimore and Ohio Railroad, Baltimore, Maryland.
- EMERSON, HARRINGTON**, Efficiency Engineer, Room 1522, Hudson Terminal Building, 30 Church Street, New York City, New York.
- EMERY, A. H.**, Civil and Mechanical Engineer, Glenbrook, Connecticut.
- ENGELHARD, CHARLES**, Importer, Hudson Terminal Building, 30 Church Street, New York City, New York.

- EPPELSHEIMER, DANIEL, JR., Chief Engineer, 419 Broadway, Middletown, Ohio.
- ERHART, WILLIAM H., Manufacturing Chemist, 81 Maiden Lane, New York City, New York.
- ETTENDER, R. L., Consulting Mechanical Engineer, Southern Railway 1300 Pennsylvania Avenue, Washington, D. C.
- EVANS, OWEN BROOKE, Mechanical Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- EVANS, POWELL, 2035 Washington Avenue, Philadelphia, Pennsylvania.
- EVANS, WAYNE S., Manufacturer of Metal Goods, 4623 Paul Street, Frankford, Philadelphia, Pennsylvania.
- EVE, A. S., Professor of Physics, McGill University, Montreal, Canada.
- EYANSON, J. EDWARD, 207 South 10th Street, Philadelphia, Pennsylvania.
- FABRY, CHARLES, Professor of Physics, University of Paris, 1 Rue Victor-Cousin, Paris (5e), France.
- FAHRIG, ERNEST, Mining Engineer, 117 North Massachusetts Avenue, Atlantic City, New Jersey.
- FAIRCHILD, S. E., JR., Civil and Mining Engineer, Land Title Building, Philadelphia, Pennsylvania.
- FALKENAU, ARTHUR, Industrial Engineer, 911 Park Avenue, New York City, New York.
- FARNUM, WILLIAM C., Mechanical Engineer, 59 Mt. Vernon Street, Fitchburg, Massachusetts.
- FARRAND, DUDLEY, Assistant to the President, Public Service Corporation of New Jersey, 80 Park Place, Newark, New Jersey.
- FAUGHT, L. ASHLEY, Dentist, Medical Arts Building, Philadelphia, Pennsylvania.
- FEARON, CHARLES, Banker, 333 Chestnut Street, Philadelphia, Pennsylvania.
- FEARING, FREDERICK C., Consulting Engineer, 1614 Pennsylvania Building, Philadelphia, Pennsylvania.
- FEBIGER, C. C., 3421 Powelton Avenue, Philadelphia, Pennsylvania.
- FELLOWS, E. R., President and General Manager, The Fellows Gear Shaper Company, Springfield, Vermont.
- FELS, MAURICE, 4305 Spruce Street, Philadelphia, Pennsylvania.
- FELS, SAMUEL S., Soap Manufacturer, 39th and Walnut Streets, Philadelphia, Pennsylvania.
- FELTON, EDGAR CONWAY, President, Pennsylvania Steel Company, and for mail, Haverford, Pennsylvania.
- FELTON, JOHN G., Manager, Wisconsin-Minnesota Light and Power Company, La Crosse, Wisconsin.
- FELTON, SAMUEL M., President, Chicago Great Western Railway, 1121 Peoples Gas Building, Chicago, Illinois.
- FERGUSON, LOUIS A., Vice President and Electrical Engineer, Commonwealth Edison Company, Box 767, 72 West Adams Street, Chicago, Illinois.
- FERGUSON, WALTER B., 426 School Lane, Germantown, Philadelphia, Pennsylvania.
- FERNALD, ROBERT HEYWOOD, Whitney Professor of Dynamical Engineering, Mechanical Engineering Department, University of Pennsylvania, Philadelphia, Pennsylvania.
- FERNANDEZ, GUY D., Electrical Engineer, Haddon Heights, New Jersey.
- FERREE, Dr. C. E., Teacher, Bryn Mawr College, Bryn Mawr, Pennsylvania.
- FINKBINER, E. W., Representative, E. F. Houghton Company, and for mail, 207 Market Street, Newark, New Jersey.
- FINLEY, W. H., President, C. & N. W. Railway Company, and for mail, 412 N. Washington Street, Wheaton, Illinois.
- FISHER, E. C., Vice President and General Manager, The Wilkes Boiler Company, and for mail, 308 North Jefferson Avenue, Saginaw, Michigan.
- FISHER, THOMAS, General Manager, Berwind White Coal Mining Company, 1100 Commercial Trust Building, Philadelphia, Pennsylvania.
- FITTS, JAMES LOGAN, Mechanical Engineer, in care of Warren Webster and Company, Point and Pearl Streets, Camden, New Jersey.
- FITZ, E. M., Electrical Engineer, Room 611, New First National Bank Bldg., Columbus, Ohio.
- FITZGERALD, FRANCIS A. J., Consulting Engineer and President, The Fitzgerald Laboratories, Niagara Falls, New York.
- FITZMAURICE, WILLIAM J., JR., Civil Engineer, 747 Marlyn Road, Philadelphia, Pennsylvania.
- FLANAGAN, CHARLES L., Insurance, Riverton, New Jersey.
- FLANAGAN, LOUIS A., Riverton, New Jersey.
- FLANDERS, RALPH E., Manager, Jones and Lamson Machine Company, and for mail, 41 Pleasant Street, Springfield, Vermont.
- FLEISHER, B. W., Manufacturer, 2301 Green Street, Philadelphia, Pennsylvania.

- FLEMING, FRANCIS P.**, Attorney-at-Law, 301 Heard Building, Jacksonville, Florida.
- FLETCHER, W. E.**, Technical Director, Atlas Powder Company, Wilmington, Delaware.
- FLYNN, JAMES A.**, Production Engineer, 3133 Camac Street, Philadelphia, Pennsylvania.
- FOERSTERLING, H.**, Chemist, in care of The Abor Farm, Jamesburg, New Jersey.
- FOOTE, ARTHUR DE WINT**, Civil Engineer, North Star Mines, Grass Valley, California.
- FOOTE, W. M.**, Manufacturer of and Dealer in Mineral Products, Swarthmore, Pennsylvania.
- FORBES, GEORGE**, Professor of Electrical Engineering, No. 11 Little College Street, Westminster, S. W., London, England.
- FORD, BRUCE**, Vice President, Electric Storage Battery Company, and for mail, 25 Summit Street, Chestnut Hill, Philadelphia, Pennsylvania.
- FORD, TERRENCE J.**, Assistant Inspector of Ordnance U. S. Navy, and for mail, 847 E. Fourth Street, Bethlehem, Pennsylvania.
- FORREST, CHARLES N.**, Manager, Technical Department, Barber Asphalt Paving Company, Maurer, New Jersey.
- FORSTALL, WALTON**, Gas Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- FOSTER, CHARLES E.**, Lawyer and Mechanical Expert, 1826 Spruce Street, Philadelphia, Pennsylvania.
- FOWLER, CLARENCE P.**, Consulting Engineer, Graham, Parson and Company, and for mail, 107 Elmwood Avenue, Narberth, Pennsylvania.
- FRANK, EDWIN**, Mechanical Engineer, C. H. Wheeler Manufacturing Company, Lehigh and Sedgley Avenues, Philadelphia, Pennsylvania.
- FRANKLIN, BENJAMIN**, Civil and Consulting Engineer, 906-7 Crozer Building, Philadelphia, Pennsylvania.
- FRANKLIN, MILTON W.**, Consulting Engineer, Remy Electric Company, Anderson, Indiana.
- FRAZER, PERSIFOR, JR.**, Shipbuilder, Merchant Shipbuilding Company, Estey Building, Philadelphia, Pennsylvania.
- FRAZIER, GEORGE H.**, Banker, P. O. Box 1630, Philadelphia, Pennsylvania.
- FRAZIER, W. W., JR.**, Sugar Refiner, Lock Box 1630, Philadelphia, Pennsylvania.
- FREAR, WILLIAM**, Chemist, State College, Pennsylvania.
- FREEMAN, HAROLD A.**, (Retired), St. Davids, Pennsylvania.
- FREEMAN, W. W.**, President, The Union Gas and Electric Company, 4th and Plum Streets Cincinnati, Ohio.
- FRENCH, HOWARD B.**, Manufacturer, 410 Callowhill Street, Philadelphia, Pennsylvania.
- FRERICHS, Dr. F. W.**, Vice President, Herf and Frerichs Chemical Company, St. Louis, Missouri.
- FRETZ, E. S.**, Manufacturer, The Light Manufacturing and Foundry Company, Pottstown, Pennsylvania.
- FRIES, HAROLD H.**, Manufacturing Chemist, 92 Reade Street, New York City, New York.
- FRUTCHY, CHARLES**, Superintendent, Ingersoll-Rand Company, Phillipsburg, New Jersey.
- FRY, ANN W.**, 6433 Jefferson Street, Germantown, Philadelphia, Pennsylvania.
- FRYER, GEORGE G.**, Mechanical Engineer, 203 Onondaga Avenue, Syracuse, New York.
- FUGUET, HOWARD**, 560 Bullitt Building, 121-141 South Fourth Street, Philadelphia, Pennsylvania.
- FULLER, GEORGE W.**, Consulting Engineer, 170 Broadway, New York City, New York.
- FULWEILER, W. H.**, Engineer, United Gas Improvement Company, 310 Arch Street, Philadelphia, Pennsylvania.
- FUNK, N. E.**, Electrical Engineer, 930 Wynnewood Road, Philadelphia, Pennsylvania.
- FURNESS, HORACE HOWARD, JR.**, Writer, 701 Stephen Girard Building, Philadelphia, Pennsylvania.
- FURNESS, RADCLIFFE**, Engineer of Research, Midvale Steel Company, P. O. Box 1606, Philadelphia, Pennsylvania.
- GAGE, Dr. HENRY PHELPS**, Physicist, Chief, Optical Division, Corning Glass Works, and for mail, 212 Chemung Street, Corning, New York.
- GARDNER, HENRY A.**, Chemical Engineer, Assistant Director, Institute of Industrial Research, Washington, D. C.
- GARRELS, W. L.**, Consulting Engineer, R. R. 5, Box 107, Webster Grove, Missouri.
- GARRISON, F. LYNWOOD**, Mining Engineer, 1019 Clinton Street, Philadelphia, Pennsylvania.
- GARTLEY, WILLIAM H.**, Engineer of Gas Manufacture, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- GAZZAM, JOSEPH M.**, Retired Lawyer, 265 South 19th Street, Philadelphia, Pennsylvania.
- GEIST, C. H.**, Land Title Building, Philadelphia, Pennsylvania.
- GESELL, W. H.**, Chemical Engineer, Lehn & Pink, Inc., Bloomfield, New Jersey.

- GEST, WILLIAM P., President, Fidelity Trust Company, 327 Chestnut Street, Philadelphia, Pennsylvania.
- GETMAN, Dr. FREDERICK H., Chemist, Hillside Laboratory, Stamford, Connecticut.
- GFROERER, A. H., Engineer, The Automatic Transportation Company, 2933-65 Main Street, Buffalo, New York.
- GHARDI, BANCROFT, Engineer of Plant, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
- GIBBONS, JOSEPH E., Laboratory Assistant, 1528 Glenwood Avenue, Philadelphia, Pennsylvania.
- GIBBS, A. E., Chemist, Pennsylvania Salt Manufacturing Company, Widener Building, Philadelphia, Pennsylvania.
- GIBBS, ALFRED W., Chief Mechanical Engineer, Pennsylvania Railroad Company, Broad Street Station, Philadelphia, Pennsylvania.
- GIBBS, E. L., Inspector, Interstate Commerce Commission, and for mail, 2004 Herschell Street, Jacksonville, Florida.
- GIBBS, WEBB L., Lubricating Engineer, 7734 South Shore Drive, Chicago, Illinois.
- GIBSON, J. J., District Manager, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania.
- GILBRETH, FRANK E., Consulting Engineer, 68 Eagle Rock Way, Montclair, New Jersey.
- GILCHRIST, JOHN F., Vice President, Commonwealth Edison Company, Edison Building, Chicago, Illinois.
- GILL, JOHN D., Chemical Engineer, Atlantic Refining Company, 3144 Passyunk Avenue, Philadelphia, Pennsylvania.
- GILLMOR, R. E., Electrical Engineer, 72 Westmont Boulevard, Montreal, Canada.
- GILPIN, FRANCIS H., Gas Engineer, 22 Edgemont Avenue, Summit, New Jersey.
- GITTLESAN, FRANK, Violinist, 28 E. Mt. Vernon Place, Baltimore, Maryland.
- GLENDINNING, ROBERT E., Banker, 400 Chestnut Street, Philadelphia, Pennsylvania.
- GLOVER, HENRY, Manufacturer, 3123 Midvale Avenue, Philadelphia, Pennsylvania.
- GLOVER, ROLFE E., JR., Chemist, 1022 Jackson Street, Wilmington, Delaware.
- GOLDBAUM, JACOB, S., Research Chemist, 4234 Spruce Street, Philadelphia, Pennsylvania.
- GOLDSCHMIDT, V., Professor, Heidelberg University, and for mail, Gaisberg Strasse 9, Heidelberg, Germany.
- GOLDSMITH, EDWARD, Retired Chemist, 658 North 10th Street, Philadelphia, Pennsylvania.
- GOLDSMITH, EDWIN M., Manufacturer, Friedberger-Aaron Manufacturing Company, Logan Station, Philadelphia, Pennsylvania.
- GOMBERG, MOSES, Professor of Chemistry, 725 Oxford Road, Ann Arbor, Michigan.
- GOODSPEED, ARTHUR W., Professor of Physics, University of Pennsylvania, Philadelphia, Pennsylvania.
- GOODWIN, HAROLD JR., Electrical Engineer, 3927 Locust Street, Philadelphia, Pennsylvania.
- GORDON, HUGH S., Mining Engineer, 10 Nevill Court, London, England.
- GRAFTON, E. H., Chief Chemist, Quaker City Rubber Company, Wissinoming, Philadelphia, Pennsylvania.
- GRAHAM, JOHN, JR., Architect, 32 Summit Street, Chestnut Hill, Philadelphia, Pennsylvania.
- GRAHAM, W. M., Bookkeeper, 113 North 19th Street, Philadelphia, Pennsylvania.
- GRANBERY, J. H., Civil Engineer, 77 Lenox Avenue, East Orange, New Jersey.
- GRAVELL, J. H., Engineer, Tilghman-Brookbank Sand Blast Company, 149 Broadway, New York City, New York.
- GREEN, GEORGE ROSS, Electrical Engineer, Philadelphia, Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- GREENE, ARTHUR M., JR., Professor of Mechanical Engineering, Rensselaer Polytechnic Institute, and for mail, Sunnyslope, Spring Avenue, Troy, New York.
- GREENWOOD, RICHARD, Acting Superintendent, 1212 Allengrove Street, Frankford, Philadelphia, Pennsylvania.
- GREENWOOD, TALMA TEMPLE, Research Engineer and Patent Solicitor, 40 Court Street, Boston, Massachusetts, and for mail, East Templeton, Massachusetts.
- GRIBBEL, JOHN, Gas Meter Manufacturer, 1513 Race Street, Philadelphia, Pennsylvania.
- GRIBBEL, W. GRIFFIN, Gas Meter Manufacturer, 1513 Race Street, Philadelphia, Pennsylvania.
- GRIEST, THOMAS H., Civil Engineer, 1631 Arch Street, Philadelphia, Pennsylvania.
- GRIFFIN, FRANK H., Chief Chemist, Viscose Company, Marcus Hook, Pennsylvania.
- GRIFFIN, MARTIN L., Chemist, Mt. Hope Finishing Company, North Dighton, Massachusetts.

- GRIFFITH, WILLIAM**, Mining Engineer and Geologist, Coal Exchange Building, Scranton, Pennsylvania.
- GRIFFITH, W. O.**, Stenton and Evergreen Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- GRISCOM, RODMAN E.**, Banker, 231 Land Title Building, Philadelphia, Pennsylvania.
- GRISSINGER, ELWOOD**, Consulting Electrical and Mechanical Engineer, 293 Lexington Avenue, Buffalo, New York.
- GUBELMAN, FREDERICK J.**, President, The Regina Company, and for mail, Woodland Ave., Englewood, New Jersey.
- GUCKER, F. T.**, Civil Engineer and Contractor, 1450 Real Estate Trust Building, Philadelphia, Pennsylvania.
- GUDEMAN, Dr. EDWARD**, Consulting Scientific Expert, 903 Postal Telegraph Building, Chicago Illinois.
- GUTHRIE, BAYARD**, Superintendent, Crucible Steel Company of America, 4414 Fifth Avenue, Pittsburgh, Pennsylvania.
- HAGAR, WALTER F., JR.**, Manufacturer, Keystone Screw Company, Yardley, Pennsylvania.
- HAHN, C. V.**, Lieutenant, U. S. A. Ordnance Department, P. O. Box 4039, Philadelphia, Pennsylvania.
- HAINES, CASPER WISTAR**, Civil Engineer, 6026 Germantown Avenue, Philadelphia, Pennsylvania.
- HAINES, ROBERT B., JR.**, Manufacturer of Rolling Mill Gauges and Haines' Automatic Micrometer, 156 West School Lane, Germantown, Philadelphia, Pennsylvania.
- HAINES, WILLIAM A.**, Manufacturer of Fancy Leather Goods, 6445 Wissahickon Avenue, Philadelphia, Pennsylvania.
- HAINES, WILLIAM J.**, Real Estate, 1011 Chestnut Street, Philadelphia, Pennsylvania.
- HALE, HENRY S.**, 2005 Chestnut Street, Philadelphia, Pennsylvania.
- HALL, C. A.**, Chemical Engineer, Cresheim Arms, Allen Lane, Philadelphia, Pennsylvania.
- HALL, R. T.**, Rear Admiral, U.S.N., Inspector of Machinery, William Cramp and Sons' Ship and Engine Building Company, Philadelphia, Pennsylvania.
- HALSEY, WILLIAM B.**, Electrical Engineer, 27 Fairview Place, corner Church Avenue, Brooklyn, New York.
- HAMILTON, TABER**, Superintendent, Louisville Division, P. C. C. and St. L. R. R. Company, 1335 W. Main Street, Louisville, Kentucky.
- HAMMER, EDWARD W.**, Consulting Engineer, 160 Broadway, New York City, New York.
- HAMMER, WILLIAM J.**, Consulting Electrical Engineer, Hotel Earle, 103 Waverly Place, New York City, New York.
- HAND, JOHN L.**, Nautical Instruments, Haddonfield, New Jersey.
- HANTHORN, JOSEPH R.**, Mechanical Engineer, 4135 Girard Avenue, Philadelphia, Pennsylvania.
- HARDING, WILLIAM H.**, Cement Manufacturer, Mechanical and Electrical Engineer, 1722 Land Title Building, Philadelphia, Pennsylvania.
- HARRIS, FRANKLIN M.**, Brick Mason, Parkside Apartments, 40th Street and Girard Avenue, Philadelphia, Pennsylvania.
- HARRISON, ALFRED C.**, Retired Sugar Refiner, 660 Drexel Building, Philadelphia, Pennsylvania.
- HARRISON, Dr. CHARLES C.**, (Retired), 400 Chestnut Street, Philadelphia, Pennsylvania.
- HARRISON, GEORGE L.**, (Retired), 1704 Locust Street, Philadelphia, Pennsylvania.
- HARRISON, J. K. M.**, Engineer, Harrison and Company Drexel Building, Philadelphia, Pennsylvania.
- HARRISON, MITCHELL**, Financier, Nokesville, Virginia.
- HARRISON, WILLIAM W.**, Merchant, 119 North 11th Street, Philadelphia, Pennsylvania.
- HART, CHARLES**, President, Delaware River Steel Company, Chester, Pennsylvania.
- HART, EDWARD**, Professor of Chemistry, Lafayette College, Easton, Pennsylvania.
- HARTNESS, JAMES**, President, Jones and Lamson Machine Company, and for mail, 30 Orchard Street, Springfield, Vermont.
- HARTUNG, ADOLPH**, Paper Merchant, 506 Race Street, Philadelphia, Pennsylvania.
- HARTZEL, FRANCIS W.**, Carburetted Water Gas Manufacturer, 932 Cheltenham Road, Philadelphia, Pennsylvania.
- HARVEY, RICHARD P.**, Engineer, R. F. D. No. 1, Box 16, San Mateo, California.
- HASCHKA, FERD. T.**, Watchmaker, Tiffany and Company, and for mail, 135 West 78th Street, New York City, New York.
- HASTINGS, R. C. M.**, Inventor, The International Telephone Company, Columbus Savings and Trust Building, Columbus, Ohio.
- HATTON, T. CHALKLEY**, Chief Engineer, Sewage Commission, City Hall, Milwaukee, Wisconsin.

- HAUPT, LEWIS M.**, Consulting Engineer, Cynwyd, Pennsylvania.
- HAWKINS, J. DAWSON**, Metallurgist, Colorado Springs, Colorado.
- HAWKSWORTH, FRANKLIN G.**, Dentist, 314 North 13th Street, Philadelphia, Pennsylvania.
- HAYWARD, NATHAN**, President, American Dredging Company, Consulting Engineer, The Bell Telephone Company of Pennsylvania, 308 Chestnut Street, Philadelphia, Pennsylvania.
- HAZEN, ALLEN**, Consulting Civil Engineer, 42nd Street Building, New York City, New York.
- HEILMAN, D. B.**, Safety Engineer, Bernharts, Pennsylvania.
- HEITMANN, EDWARD**, Electrical Engineer, Fairmount Hotel, 2595 Boulevard, Jersey City, New Jersey.
- HELME, WILLIAM E.**, Manufacturer, 1330 Cherry Street, Philadelphia, Pennsylvania.
- HENDERSON, GEORGE R.**, Consulting Engineer, Aldine Hotel, 1920 Chestnut Street, Philadelphia, Pennsylvania.
- HENRY, W. C. A.**, Superintendent of Motive Power, Pennsylvania Lines West of Pittsburgh, 1106 Syndicate Trust Building, St. Louis, Missouri.
- HENSON, EDWARD FRANCIS**, Lumber Merchant, 921 North Delaware Avenue, Philadelphia, Pennsylvania.
- HEPBURN, Dr. JOSEPH SAMUEL**, Biological Chemist, Hering Laboratory, Hahneman Medical College, Philadelphia, Pennsylvania.
- HERING, Dr. CARL**, Consulting Electrical Engineer, 1317 Spruce Street, Philadelphia, Pennsylvania.
- HERING, RUDOLPH**, Consulting Hydraulic and Sanitary Engineer, Spencer Arms, 140 West 69th Street, New York City, New York.
- HERING, WALTER E.**, President, The Globe Ticket Company, 112 North 12th Street, Philadelphia, Pennsylvania.
- HERR, EDWIN M.**, President, Westinghouse Electric and Manufacturing Company, and for mail, 140 Hutchinson Avenue, Edgewood Park, Pennsylvania.
- HERRESHOFF, NATHANAEAL GREENE**, Naval Architect and Marine Engineer, Herreshoff Manufacturing Company, Bristol, Rhode Island.
- HERSAM, ERNEST A.**, Associate Professor of Metallurgy, University of California, Berkeley, California.
- HERTY, CHARLES H.**, Chemist, 35 East 41st Street, New York City, New York.
- HESS, HENRY**, Mechanical Engineer, 928 Witherspoon Building, Philadelphia, Pennsylvania.
- HESS, WALTER C.**, Paint Manufacturer, 1813 Erie Avenue, Philadelphia, Pennsylvania.
- HETZEL, FREDERIC V.**, Mechanical Engineer, P. O. Box 306, West Chester, Pennsylvania.
- HEXAMER, CHARLES A.**, Civil Engineer, Bullitt Building, Philadelphia, Pennsylvania.
- HEXAMER, C. J.**, Civil Engineer, The Bartram, 33d and Chestnut Streets, Philadelphia, Pennsylvania.
- HICKS, THOMAS W.**, Manufacturer of Farm Implements, 4516 Fremont Avenue, South Minneapolis, Minnesota.
- HIGGINS, JOHN H.**, Engineer of Tests, Camden Forge Company, Camden, New Jersey.
- HILL, JOHN W.**, Consulting Engineer, Rooms 45-46, Bodmann Building, 621 Main Street, Cincinnati, Ohio.
- HILL, ROY LINDEN**, Chemist, 619 East Broad Street, Tamaqua, Pennsylvania.
- HIRES, CHARLES E.**, Manufacturing Chemist, 206 South 24th Street, Philadelphia, Pennsylvania.
- HITCHCOCK, Dr. FANNY R. M.**, 4038 Walnut Street, Philadelphia, Pennsylvania.
- HITCHINS, ALFRED B.**, Research Chemist, in care of Ansco Company, Research Laboratory, Binghamton, New York.
- HITE, B. H.**, Chemist, West Virginia Agricultural Experiment Station, Morgantown, West Virginia.
- HOADLEY, ANTHONY DE H.**, Student, Union College, Schenectady, New York.
- HOADLEY, Professor GEORGE A.**, (Retired), Swarthmore, Pennsylvania.
- HOFSTETTER, GEORGE**, Blank Book Maker, Lithographer, 247-53 South American Street, Philadelphia, Pennsylvania.
- HOLLAND, WALTER E.**, Research Engineer, Philadelphia Storage Battery Company, Ontario and C Streets, Philadelphia, Pennsylvania.
- HOLLANDER, CHARLES S.**, Chemist and Chemical Engineer, in care of Rohm and Haas Company, Bristol, Pennsylvania.
- HOLLISTER, S. C.**, Civil Engineer, Wig Hollister and Ferguson, Land Title Building, Philadelphia, Pennsylvania.
- HOLMES, GEORGE R.**, Technical Journalist, 135 Garrison Avenue, Jersey City, New Jersey.
- HOLST, L. J. R.**, Mechanical Engineer, 6035 Carpenter Street, Philadelphia, Pennsylvania.
- HONAMAN, R. KARL**, Electrical Engineer, Development and Research Department, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
- HOOKER, SAMUEL C.**, Chemist and Sugar Refiner, 82 Remsen Street, Brooklyn, New York.

- HOOPES, PENROSE R.**, Draftsman, 1015 South Farragut Terrace, Philadelphia, Pennsylvania.
- HOPPIN, WILLIAM**, Internal Combustion Engineer, 1521 Mount Vernon Street, Philadelphia, Pennsylvania.
- HORN, DAVID W.**, Chemist, 616 Montgomery Avenue, Bryn Mawr, Pennsylvania.
- HORN, FRANKLIN S.**, Lunch Room Proprietor, 1515 Arch Street, Philadelphia, Pennsylvania.
- HORNSEY, JOHN W.**, Consulting Engineer, Summit, New Jersey.
- HORSTMANN, W.**, President, Wm. H. Horstmann and Company, 5th and Cherry Streets, Philadelphia, Pennsylvania.
- HORTON, ROBERT E.**, Consulting Hydraulic Engineer, R. F. D. No. 1, Voorheesville, New York.
- HOSKINS, WILLIAM**, Chemist, Room 2009, 11 West Monroe Street Chicago, Illinois.
- HOUSTON, SAMUEL F.**, Trustee, 509 Real Estate Trust Building, Philadelphia, Pennsylvania.
- HOWARD, A. C.**, Gas Engineer, 61 Broadway, New York City, New York.
- HOWE, ARTHUR W.**, Broker, 1811 Walnut Street, Philadelphia, Pennsylvania.
- HOWE, F. P.**, Iron Manufacturer, 242 South 17th Street, Philadelphia, Pennsylvania.
- HOWELL, JOHN W.**, Engineer, Lamp Works, General Electric Company, Harrison, New Jersey.
- HOWSON, CHARLES HENRY**, Patent Solicitor and Engineer, 32 South Broad Street, Philadelphia, Pennsylvania.
- HOWSON, MISS EMILY E.**, Instructor in Physics, Agnes Scott College, Decatur, Georgia.
- HOWSON, HENRY**, Patent Solicitor and Engineer, West End Trust Building, Philadelphia, Pennsylvania.
- HOWSON, RICHARD**, 401 Woodland Avenue, Wayne, Delaware County, Pennsylvania.
- HUFF, ERNEST L.**, Electrical Engineer, Natrona, Pennsylvania.
- HUFFNAGLE, J. VINCENT**, 88 Elgin Avenue, Westmount, New Jersey.
- HUHN, GEORGE A.**, Banker, Land Title Building, Philadelphia, Pennsylvania.
- HUMPHREY, RICHARD L.**, Consulting Engineer, Harrison Building, 15th and Market Streets, Philadelphia, Pennsylvania.
- HUMPHREYS, ALEXANDER C.**, Consulting Engineer, President, Stevens Institute of Technology, Hoboken, New Jersey.
- HUMPHREYS, W. J.**, Scientist, Weather Bureau, Washington, D. C.
- HUNT, ROBERT W.**, Consulting Engineer, 2200 Insurance Exchange Building, Chicago, Illinois.
- HUSTON, CHARLES L.**, Vice President, Lukens Steel Company, Coatesville, Pennsylvania.
- HUTCHINSON, CARY T.**, Consulting Engineer, 65 West 54th Street, New York City, New York.
- HUTCHINSON, S. PEMBERTON**, President, Westmoreland Coal Company, 224 South 3rd Street, Philadelphia, Pennsylvania.
- HUTTINGER, W. R.**, Mechanical Engineer, 86 East Greenwood Avenue, Lansdowne, Pennsylvania.
- HYDE, EDWARD P.**, Director, Nela Research Laboratory, Nela Park, Cleveland, Ohio.
- IDE, HERBERT S.**, Manufacturer, Troy, New York.
- INDAHL, MAURITZ C.**, Mechanical Engineer, 248 East Johnson Street, Philadelphia, Pennsylvania.
- INSULL, SAMUEL**, President, Commonwealth Edison Company, 72 West Adams Street, Chicago, Illinois.
- ISRAEL, JOSEPH D.**, District Manager, The Philadelphia Electric Company, 10th and Chestnut Streets, Philadelphia, Pennsylvania.
- ITTNER, MARTIN HILL**, Chief Chemist, Colgate and Company, Jersey City, New Jersey.
- IVES, FRED E.**, Inventor, 1327 Spruce Street, Philadelphia, Pennsylvania.
- IVES, HERBERT E.**, Physicist, in care of Western Electric Company, 463 West Street, New York City, New York.
- JACKSON, A. C.**, Manufacturer, 4530 Tacony Street, Philadelphia, Pennsylvania.
- JACKSON, JOHN PRICE**, Pennsylvania Commissioner of Labor and Industry, Harrisburg, Pennsylvania.
- JACKSON, WILLIAM STELL**, Patent Attorney, 1001 Chestnut Street, Philadelphia, Pennsylvania.
- JACOBUS, D. S.**, Advisory Engineer, The Babcock and Wilcox Company, 85 Liberty Street, New York City, New York.
- JANNEY, JOSEPH A., JR.**, Chestnut Hill, Philadelphia, Pennsylvania.
- JEANES, ISAAC W.**, 8 Chestnut Street, Philadelphia, Pennsylvania.
- JEFFERSON, J. P.**, Manufacturer, P. O. Box 645, Santa Barbara, California.
- JEFFERIES, ZAY**, Metallurgical Engineer, in care of Aluminum Castings Company, 2800 Harvard Avenue, Cleveland, Ohio.

- JELLISON, B. T.**, Purchasing Agent, Chesapeake and Ohio Railway Company, Richmond, Virginia.
- JENKINS, C. FRANCIS**, Inventor, 5502 16th Street, N. W., Washington, D. C.
- JENKINS, THEODORE F.**, Attorney-at-Law, 1100 Franklin Bank Building, Philadelphia, Pennsylvania.
- JENNINGS, W. N.**, Business Photographer, 1321 Arch Street, Philadelphia, Pennsylvania.
- JICKLING, ROBERT LEE**, National Aniline & Chemical Company, Laboratory, Marcus Hook, Pennsylvania.
- JOB, ROBERT**, Vice President, Milton Hersey Company, Limited, 84 St. Antoine Street, Montreal, Quebec.
- JOHANSEN, ERNEST**, Chemist, 439 South 51st Street, Philadelphia, Pennsylvania.
- JOHNSON, A. L.**, Vice President and General Manager, Corrugated Bar Company, 402 Mutual Life Building, Buffalo, New York.
- JOHNSON, JAMES CURTIS**, General Superintendent of Transportation, Pennsylvania Railroad Co., Broad Street Station, Philadelphia, Pennsylvania.
- JOHNSON, WALTER H.**, First Vice President Philadelphia Electric Co., 1000 Chestnut Street, Philadelphia, Pennsylvania.
- JONES, JONATHAN**, Engineer, Manager McClintic-Marshall Products Company, Tatagar, B. N. Railway, India.
- JONES, JONATHAN R.**, Iron and Steel Manufacturer, 1800 Widener Bldg., Philadelphia, Pennsylvania.
- JONES, JULIAN D.**, Superintendent, Telegraph and Signals, Eastern Region, Pennsylvania System, Room 152, Broad Street Station, Philadelphia, Pennsylvania.
- JONES, J. LEVERING**, Attorney-at-Law, 705 Land Title Building, Philadelphia, Pennsylvania.
- JONES, W. CLYDE**, Attorney-at-Law, 105 West Monroe Street, Chicago, Illinois.
- JUNKERFELD, P.**, Engineer and General Supervisor in Electric Supply Business, Stone and Webster Engineering Corporation, 147 Milk St., Boston, Massachusetts.
- JUSTI, HENRY D.**, Manufacturer, 32nd and Spring Garden Sts., Philadelphia, Pennsylvania.
- JUSTI, HENRY M.**, 32nd and Spring Garden Sts., Philadelphia, Pennsylvania.
- KALTENTHALER, H. J.**, Manufacturer of Steam Specialties, 6457 Woodbine Ave., Overbrook, Philadelphia, Pennsylvania.
- KARRER, ENOCH**, Physicist, Nela Research Laboratory, Nela Park, Cleveland, Ohio.
- KAUFMAN, H. M.**, General Manager, Mutual Chemical Company of America, 110 William Street, New York City, New York.
- KEBLER, LEONARD**, President, Ward Leonard Electric Company, Mt. Vernon, New York and for mail, Avon Road, Bronxville, New York.
- KEITH, C. P.**, in care of W. G. Peters, 69 Van Antwerp Road, Schenectady, New York.
- KELLER, E. E.**, Engineer and Manufacturer, 717 Mt. Hope Avenue, Rochester, New York.
- KELLER, HARRY F.**, Educator and Chemist, Philadelphia, Pennsylvania.
- KELLOGG, HOSFORD D.**, Manager, The H. B. Smith Co., 17th and Arch Streets, Philadelphia, Pennsylvania.
- KELLEY, GEORGE L.**, Research Chemist, Library, Midvale Steel Company, Philadelphia, Pennsylvania.
- KELLY, JOHN FORREST**, Electrical Engineer, 284 West Housatonic Street, Pittsfield, Massachusetts.
- KEMMERER, M. S.**, Coal Merchant, Mauch Chunk, Pennsylvania.
- KENNEDY, FRANK G., JR.**, President, Logan Iron and Steel Company, 1218 Stephen Girard Building, and for mail, 2043 Spruce Street, Philadelphia, Pennsylvania.
- KENNEDY, J. J.**, Consulting Engineer, 52 Broadway, New York City, New York.
- KENNEDY, M. C.**, Vice President, Pennsylvania Railroad Company, Broad Street Station, Philadelphia, Pennsylvania.
- KENNELLY, Dr. A. E.**, Professor of Electrical Engineering, c/o Morgan, Harjes and Company 14 Place Vendome, Paris, France.
- KENT, A. ATWATER**, Manufacturer, Ardmore, Pennsylvania.
- KENT, S. LEONARD, JR.**, Hydro-Electrics, Manayunk, Philadelphia, Pennsylvania.
- KERLIN, W. D.**, Secretary and Treasurer, Camden Forge Company, Camden, New Jersey.
- KERR, WILLIAM M.**, Manufacturer, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- KERSHNER, JEFFERSON E.**, Professor of Mathematics and Physics, 445 West Chestnut Street, Lancaster, Pennsylvania.
- KETCHAM, O. W.**, Manufacturer of Architectural Terra Cotta, 24 South Seventh Street, Philadelphia, Pennsylvania.
- KETTERLINUS, J. L.**, Lithographer, 4th and Arch Streets, Philadelphia, Pennsylvania.
- KILPATRICK, J. L.**, Aberdale Road, Bala, Pennsylvania.
- KIMBER, WILLIAM M. C.**, Manufacturer of Electrical Instruments, Leeds and Northrup Company, 4901 Stenton Avenue, Germantown, Philadelphia, Pennsylvania.

- KINEALY, JOHN HENRY**, Consulting Engineer, 503 Granite Building, St. Louis, Missouri.
- KING, CHARLES W. G.**, Mechanical Engineer, 125 Linden Avenue, Rutledge, Delaware County Pennsylvania.
- KINGSBURY, Dr. EDWIN F.**, Physicist, Western Electric Company, 463 West Street, New York City, New York.
- KINNIER, GEORGE E.**, Civil Engineer, 20 Red Bank Avenue, Woodbury, New Jersey.
- KIPPENBERT, HENRY**, in care of Merck and Company, Rahway, New Jersey.
- KIRK, C. J.**, President, United States Sherardizing Company, New Castle, Pennsylvania.
- KLEMM, J. GEORGE, JR.**, Heating and Ventilating Engineer, Box 284, Haverford, Pennsylvania.
- KLINE, C. MAHLON**, Wholesale Druggist, 429 Arch Street, Philadelphia, Pennsylvania.
- KLIPSTEIN, A.**, Merchant, 644-54 Greenwich Street, New York City, New York.
- KLUMPP, JOHN BARTLEMAN**, Inspecting Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- KNAND, ARTHUR**, Petroleum Engineer, The United Gas Improvement Company, Broad and Arch Streets, and for mail, 210 Strathmore Road, Upper Darby, Philadelphia, Pennsylvania.
- KNAPP, I. N.**, Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- KNEASS, STRICKLAND L.**, Mechanical Engineer, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- KNOEDLER, E. L.**, General Superintendent, The Welsbach Company, Gloucester, New Jersey.
- KNOWLES, MORRIS**, Director, Department of Sanitary Engineering, University of Pittsburgh, and for mail, 1200 B. F. Jones Law Building, 4th Avenue and Ross Street, Pittsburgh, Pennsylvania.
- KNOX, HENRY HOBART**, Address unknown.
- KOCH, GEORGE B.**, General Foreman, South Altoona Foundries, Pennsylvania Railroad Company, Altoona, Pennsylvania.
- KOCH, JULIUS A.**, Professor of Chemistry and Dean of School of Pharmacy, University of Pittsburgh, Bluff and Pride Streets, Pittsburgh, Pennsylvania.
- KOHLER, JOHN J.**, Manager, 4121 North 6th Street, Philadelphia, Pennsylvania.
- KOHN, JOSEPH**, Secretary and Treasurer, Universal Dental Company, 2204 Natrona Street, Philadelphia, Pennsylvania.
- KOLB, HENRY M.**, Representative, Manufacturers' Specialties Machinery, 1400 Widener Building, Philadelphia, Pennsylvania.
- KOTHNY, G. L.**, Consulting Engineer, C. H. Wheeler Manufacturing Company, and for mail, Woodland Road, Strafford, Pennsylvania.
- KREBS, A. S.**, Mechanical Engineer, Krebs Pigment and Chemical Company, Newport, Delaware.
- KREBS, H. J.**, President, Krebs Pigment and Chemical Company, P. O. Box 951, Wilmington, Delaware.
- KRUTTSCHNITT, J.**, Civil Engineer, Southern Pacific Company, 165 Broadway, New York City, New York.
- KUHN, C. HARTMAN**, 202 Liberty Building, Philadelphia, Pennsylvania.
- KUTTROFF, EDWIN**, President, Verona Chemical Company, North Newark, New Jersey.
- LAIRD, CLINTON N.**, Chemist, Canton Christian College, Canton, China.
- LANDRETH, C. P.**, Manufacturer, Electrolytic Purification Company, 15th Street and Lehigh Avenue, Philadelphia, Pennsylvania.
- LANE, DAVID H.** (Retired), 408 Land Title Building, Philadelphia, Pennsylvania.
- LANZA, GAETANO**, Engineer, Special Consultant, The Baldwin Locomotive Works, and for mail, The Montevista, 63rd and Oxford Streets, Philadelphia, Pennsylvania.
- LAUER, CONRAD**, General Manager, Day and Zimmerman, 4918 Greene Street, Philadelphia, Pennsylvania.
- LAVINO, E. J.**, Merchant, 471 Bullitt Building, Philadelphia, Pennsylvania.
- LAWALL, CHARLES H.**, Analytical Chemist, 636 Franklin Square, Philadelphia, Pennsylvania.
- LAWES, T. A.**, Mechanical Engineer, N. Y. C. & St. L. R. R., Cleveland, Ohio.
- LAWLER, G. S.**, Electrical Engineer, Associated Mutual Fire Insurance Companies, 31 Milk Street, Boston, Massachusetts.
- LE BOUTILLIER, HENRY W.**, Chemist, Wayne, Pennsylvania.
- LE BOUTILLIER, ROBERT**, Wayne, Pennsylvania.
- LEDoux, J. W.**, Chief Engineer, American Pipe Manufacturing Company, 112 North Broad Street, Philadelphia, Pennsylvania.
- LEE, ELISEA**, General Manager, Pennsylvania Railroad Company, Broad Street Station, Philadelphia, Pennsylvania.
- LEE, JAMES D., JR.**, 5929 Greene Street, Germantown, Philadelphia, Pennsylvania.
- LEE, WALTER T.**, Accountant, 308 Rex Avenue, Chestnut Hill, Philadelphia, Pennsylvania.
- LEEDS, MORRIS E.**, Manufacturer of Electrical Measuring Instruments, 4901 Stenton Avenue, Germantown, Philadelphia, Pennsylvania.

- LEFFMANN, HENRY**, Chemist, 1839 North 17th Street, Philadelphia, Pennsylvania.
- LE MAISTRE, F. J.**, Chemical Engineer, 810 Bellevue Court Building, Philadelphia, Pennsylvania.
- LEMOINE, L. R.**, President, United States Cast Iron Pipe and Foundry Company, Morris Building, Philadelphia, Pennsylvania.
- LENHER, VICTOR**, Chemist, 158 Summit Avenue, Madison, Wisconsin.
- LENKER, WILL G.**, Civil Engineer, 405 Chestnut Street, Sunbury, Pennsylvania.
- LESLEY, ROBERT W.**, Manufacturer, 612 Pennsylvania Building, Philadelphia, Pennsylvania.
- LEVY, LIONEL FARADAY**, Chemical Engineer, Manager, Repro Art Machinery Company, and for mail, 220 West Roberts Avenue, Philadelphia, Pennsylvania.
- LEVY, MAX**, Screens for Photo-Engravers, Lenox Apartments, 13th and Spruce Streets, Philadelphia, Pennsylvania.
- LEWIS, A. NELSON**, Attorney-at-Law, 1811 Walnut Street, Philadelphia, Pennsylvania.
- LEWIS, DANIEL C.**, Agent, The Millville Manufacturing Company, Millville, New Jersey.
- LEWIS, GEORGE W.**, Mechanical Engineer, National Advisory Committee for Aeronautics 2722 Navy Building, Washington, D. C.
- LEWIS, HOWARD W.**, Banker, 1028 Spruce Street, Philadelphia, Pennsylvania.
- LEWIS, JOHN F.**, Attorney-at-Law, 208 South 4th Street, Philadelphia, Pennsylvania.
- LEWIS, NATHAN E.**, Mechanical Engineer, Babcock & Wilcox Company, 85 Liberty Street, New York City, New York.
- LEWIS, PAUL A.**, Physician, Director of Laboratory, The Henry Phipps Institute, 7th and Lombard Streets, Philadelphia, Pennsylvania.
- LEWIS, ROBERT B.**, Mechanical Engineer, 51 East Penn Street, Germantown, Philadelphia, Pennsylvania.
- LEWIS, WILFRED**, Mechanical Engineer, President, The Tabor Manufacturing Company, and for mail, Rose Lane, Haverford, Pennsylvania.
- LICHTENBERG, Captain CHESTER**, Electrical Engineer, 136 Waverly Place, Schenectady, New York.
- LIEB, J. W.**, Vice President, The New York Edison Company, 15th Street and Irving Place, New York City, New York.
- LIEBER, HUGO**, Chemist, President, H. Lieber and Company, 23 East 26th Street, New York City, New York.
- LIGHTFOOT, THOMAS M.**, Retired Educator, Chesham, New Hampshire.
- LIHME, I. P.**, Chemical Engineer, The Grasselli Chemical Company, Cleveland Ohio.
- LILLIE, LEWIS**, Vice President, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- LINDENTHAL, GUSTAV**, Consulting Engineer, 7 Dey Street, New York City, New York.
- LINDNER, JOHN**, President, Lindner Shoe Company, and for mail, Forest Hill, Carlisle, Pennsylvania.
- LINDSTROM, CHARLES A.**, Assistant to President, Pressed Steel Car Company, Farmers Bank Building, Room 1909, Pittsburgh, Pennsylvania.
- LIPPINCOTT, J. BERTRAM**, Publisher, 229 South 6th Street, Philadelphia, Pennsylvania.
- LIPPINCOTT, JOSEPH W.**, Publisher, Bethayres, Pennsylvania.
- LITTLE, ARTHUR D.**, President, Arthur D. Little, Incorporated, 30 Charles River Road, Cambridge, Massachusetts.
- LIVERSIDGE, HORACE P.**, Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- LIVINGSTON, HERMAN**, Hydro Carbon Engineer, Calco Chemical Company, Bound Brook, New Jersey.
- LLEWELLYN, W. H.**, Druggist, 1518 Chestnut Street, Philadelphia, Pennsylvania.
- LLOYD, HERBERT**, President, Electric Storage Battery Company, Philadelphia, Pennsylvania.
- LLOYD, JOHN URI**, Manufacturing Pharmacist and Chemist, in care of The Lloyd Library, 390 West Court Street, Cincinnati, Ohio.
- LLOYD, MORTON G.**, Electrical Engineer, Bureau of Standards, Washington, D. C.
- LOBSEN, PEDER**, Mechanical Engineer, Room No. 2, Keyser's Gade 1, Kristiania, Norway.
- LODGE, ROLLA M.**, Engineer and Electrician, 1149 Venango Street, Philadelphia, Pennsylvania.
- LOEB, LEO**, Mechanical Engineer, Day and Zimmerman, Incorporated, 611 Chestnut Street, Philadelphia, Pennsylvania.
- LONERGAN, J. E.**, Brass Manufacturer, 211 Race Street, Philadelphia, Pennsylvania.
- LONGSTRETH, CHARLES**, President, Metallic Packing Company, and for mail, Racquet Club, Philadelphia, Pennsylvania.
- LONGSTRETH, EDWARD T.**, Manufacturer, 6805 North 11th Street, Oak Lane, Philadelphia, Pennsylvania.

- LORENTZ, HENDRIK A.**, Physicist, Zylweg 76, Haarlem, Holland.
- LOSS, HENRIK VON Z.**, Consulting Engineer, Witherspoon Building, Philadelphia, Pennsylvania.
- LOVEJOY, J. R.**, Vice President, General Electric Company, Schenectady, New York.
- LOVEKIN, LUTHER D.**, Chief Engineer, New York Shipbuilding Company, Camden, New Jersey, and for mail, Mill Creek Road, Ardmore, Pennsylvania.
- LOWE, ARTHUR W.**, Public School Teacher, 1224 Herbert Street, Frankford, Philadelphia, Pennsylvania.
- LOYD, MISS SARAH A. C.**, 1206 Filbert Street, Philadelphia, Pennsylvania.
- LUCAS, A. F.**, Mining Engineer, 2300 Wyoming Avenue, Washington, D. C.
- LUCKE, CHARLES EDWARD**, Professor of Mechanical Engineering, Columbia University, New York City, New York.
- LUCKIESH, Dr. M.**, Director of Applied Science, Nela Research Laboratories, Nela Park, Cleveland, Ohio.
- LUKENS, HIRAM S.**, Chemist, Harrison Laboratory, University of Pennsylvania, 34th and Spruce Streets, Philadelphia, Pennsylvania.
- LUPTON, EDWARD**, Manufacturer of Sheet Metal, Allegheny Avenue and Tulip Street, Philadelphia, Pennsylvania.
- LYMAN, JAMES**, Consulting Engineer, Member of Firm, Sargent & Lundy, 1412 Edison Building, Chicago, Illinois.
- LYNCH, JOHN COOPER**, General Superintendent of Traffic, The Bell Telephone Company, of Pennsylvania, 1631 Arch Street, Philadelphia, Pennsylvania.
- LYON, PERCY S.**, Chief Engineer, H. S. B. W. Cochrane Corporation, 17th Street and Allegheny Avenue, Philadelphia, Pennsylvania.
- LYSLE, FREDERIC BOWERS**, Chemist-Engineer, Room 900, City Hall, Philadelphia, Pennsylvania.
- McBRIDE, THOS. C.**, Sales Manager, Worthington Pump and Machinery Corporation, 1516 N. American Building, Philadelphia, Pennsylvania.
- McCAFFREY, EDWARD V.**, File Manufacturer, McCaffrey File Company, Philadelphia, Pennsylvania.
- McCALL, JOSEPH B.**, President, Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- McCALL, RICHARD C.**, in care of E. J. Sellers, 1830 Pine Street, Philadelphia, Pennsylvania.
- McCHESNEY, JOHN M.**, General Manager, Keystone Leather Chemical Company, 150 West Central Avenue, Moorestown, New Jersey.
- McCLELLAND, GEORGE W.**, Instructor in Mathematics, Rensselaer Polytechnic Institute, 67 First Street, Troy, New York.
- McCONNELL, FRANKLIN P.**, 100 S. 4th Street, Darby, Pennsylvania.
- McCONNELL, JACOB Y.**, Mechanical Engineer, 100 S. 4th Street, Darby, Pennsylvania.
- McCORMACK, H.**, Professor of Chemical Engineering, Armour Institute of Technology, Chicago, Illinois.
- McCOY, JOHN F., JR.**, Mechanical Engineer, Station Z., 3015 Midvale Avenue, Philadelphia, Pennsylvania.
- McDONALD, HUNTER**, Chief Engineer, N. C. & St. L. Ry. Company, 112 Tenth Avenue, North Nashville, Tennessee.
- McFADDEN, GEORGE H.**, Merchant, 121 Chestnut Street, Philadelphia, Pennsylvania.
- McGEORGE, PERCY**, Prætorian Building, Dallas, Texas.
- McGOWAN, J., JR.**, Chief Chemist, Joseph Campbell Company, 32 N. Front Street, Camden, New Jersey.
- McILHENNY, JOHN D.**, 17th and Clearfield Streets, Philadelphia, Pennsylvania.
- McILVAINE, A. ROBINSON**, Drug Importer and Manufacturer, 15th and Hamilton Streets, Philadelphia, Pennsylvania.
- McKAIG, W. WALLACE**, Mechanical Engineer, Cumberland, Maryland.
- McKEE, GEORGE M.**, Manufacturer, Donnacona, P. Q., Canada.
- McLEAN, WILLIAM L.**, Publisher, The Evening Bulletin, Philadelphia, Pennsylvania.
- McMEEKIN, Major C. W.**, 1632 Spruce Street, Berkely, California.
- McMILLIN, EMERSON**, Banker, Darlington Farms, Mahwah, New Jersey.
- McVEY, JOHN JOSEPH**, Publisher & Bookseller, 1229 Arch Street, Philadelphia, Pennsylvania.
- MacBAIN, D. R.**, Assistant General Manager, New York Central Railroad Company, Cleveland, Ohio.
- MacBETH, NORMAN**, Illuminating Engineer, 227 West 17th Street, New York City, New York.
- MacGREGOR, FRANK S.**, Development Department, E. I. du Pont de Nemours and Company, 452 Du Pont Building, Wilmington, Delaware.

- MACK, CARL T.**, Electrical Engineer, in care of Doherty Men's Club, 1329 K. Street, N. W., Washington, D. C.
- MACKENZIE, K. G.**, Consulting Chemist, The Texas Company, 17 Battery Place, New York City, New York.
- MacLEAN, GEORGE**, President, Ives Inventions, 208 West 88th Street, New York City, New York.
- MacLEAN, MALCOLM R.**, Haverford, Pennsylvania.
- MacMURPHY, FRANKLIN**, Student, 542 West 112th Street, New York City, New York.
- MADEIRA, PERCY C.**, Coal Operator, North American Building, Philadelphia, Pennsylvania.
- MAILLOUX, C. O.**, Consulting Engineer, 322 West 82nd Street, New York City, New York.
- MAINES, Dr. EUGENE L.**, Chemist, Ellis Hotel, Chattanooga, Tennessee.
- MAITLAND, HAROLD T.**, Oil Chemist, Sharon Hill, Pennsylvania.
- MALLINCKRODT, E., JR.**, Manufacturing Chemist, Mallinckrodt Chemical Works, St. Louis, Missouri.
- MANWARING, ALBERT, H.**, Electrical Engineer, The Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- MARBAKER, EDWARD E.**, Chemist, 11,416 Ashbury Avenue, N. E., Cleveland, Ohio.
- MARCONI, GUGLIELMO**, Electrical Engineer and Inventor, 31 Via Garibaldi Gianicolo Rome, Italy.
- MARKLE, A.**, Mining Engineer, Hazleton, Pennsylvania.
- MARKLE, JOHN**, Mechanical Engineer and Coal Operator, 2 Rector Street, New York City, New York.
- MARRIOTT, R. A.**, Mechanical Engineer, 811 Higgins Building, Los Angeles, California.
- MARSHALL, THOS. H.**, Carpenter and Builder, Carpenter's Hall, 320 Chestnut Street, Philadelphia, Pennsylvania.
- MARTIN, T. COMMERFORD**, Secretary, National Electric Lamp Association, 29 West 39th Street, New York City, New York.
- MARTIN, THOMAS S.**, 3rd, Civil Engineer, 7205 Cresheim Road Germantown, Philadelphia, Pennsylvania.
- MASLAND, CHARLES, H., 2nd**, Chemical Engineer, 1202 Stratford Avenue, Melrose Park, Pennsylvania.
- MASLAND, CHARLES WILLIAM**, Manufacturer, 3240 Amber Street, Philadelphia, Pennsylvania.
- MASON, CHARLES, THOMAS**, Electrical Engineer, President, Sumter Electric Company Sumter, South Carolina.
- MASON, SIDNEY**, President, Welsbach Company, Gloucester City, New Jersey.
- MASON, W. P.**, Professor of Chemistry, Rensselaer Polytechnic Institute, Troy, New York.
- MASTERS, FRANK M.**, 204 Locust Street, Harrisburg, Pennsylvania.
- MAXFIELD, H. H.**, General Superintendent, Pennsylvania System, Central Region, Pennsylvania Station, Pittsburgh, Pennsylvania.
- MAYER, NELSON B.**, Merchant, Hotel Marie Antoinette, Broadway and 67th Street, New York City, New York.
- MEASEY, WILLIAM MAUL**, Attorney-at-Law, Room 404, 1328 Chestnut Street, Philadelphia, Pennsylvania.
- MEEKER, G. H.**, Professor of Chemistry, School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania.
- MEIGS, JOSEPH V.**, Research Chemist and Chemical Engineer, 33 Clinton Street, Malden, Massachusetts.
- MELLOR, ALFRED**, Manufacturing Chemist, 152 West Walnut Lane, Germantown, Philadelphia, Pennsylvania.
- MELLOR, NORMAN**, Manufacturer, Wayne Junction, Philadelphia, Pennsylvania.
- MELODY, MICHAEL**, Bailey Building, Philadelphia, Pennsylvania.
- MENDENHALL, Dr. T. C.**, (Retired), Ravenna, Ohio.
- MERRICK, JAS. HARTLEY**, Roxborough, Philadelphia, Pennsylvania.
- MERRICK, J. V.**, Roxborough, Philadelphia, Pennsylvania.
- MERRIMAN, THADDEUS**, Department Engineer, Board of Water Supply, City of New York, Municipal Building, New York City, New York.
- MERRITT, JAMES SMITH**, Mechanical Engineer, Abington, Pennsylvania.
- MERSON, R. D.**, Consulting Engineer, 143 Liberty Street, New York City, New York.
- MERZ, CHARLES H.**, Consulting Engineer, 32 Victoria Street, London, S. W., England.
- MERZ, EUGENE**, Manufacturer, The Heller and Merz Company, Hamburg Place, Newark, New Jersey.
- METZ, HERMAN A.**, Manufacturer and Importer of Chemicals and Dyestuffs, 122 Hudson Street, New York City, New York.

- MEYER, H. CONRAD**, Vice President, Foote Mineral Company, and for mail, 203 East Willow Grove Avenue, Chestnut Hill, Philadelphia, Pennsylvania.
- MIDDLETON, ALBERT C.**, Director, 149 East Main Street, Moorestown, New Jersey.
- MILES, J. WALTER**, Electrical Engineer, Irwin, Pennsylvania.
- MILLER, ADOLPH W.**, Wholesale Drugs, 400 North 3rd Street, Philadelphia, Pennsylvania.
- MILLER, CASPER W.**, Physician, Wallingford, Pennsylvania.
- MILLER, EARL R.**, 1409 Jefferson Street, Philadelphia, Pennsylvania.
- MILLER, FRANK P.**, Frank P. Miller Paper Company, East Downton, Pennsylvania.
- MILLER, FRED J.**, Factory Manager, Stockton, New Jersey.
- MILLER, GUYON**, President, Downton Manufacturing Company, Downton, Pennsylvania.
- MILLER, SIMON**, Textile Manufacturer, 901 North 16th Street, Philadelphia, Pennsylvania.
- MILLER, W. LASH**, Professor of Physical Chemistry, and for mail, 8 Hawthorne Avenue, Toronto, Canada.
- MILLIKEN, J.**, President, The Industrial Car Manufacturer's Institute, Room 801, 68 William Street, New York City, New York.
- MILLS, GEO. M.**, President, Thomas Mills and Brothers, Incorporated, 1301 North 8th Street, Philadelphia, Pennsylvania.
- MILNE, DAVID**, Manufacturer, School House Lane, Germantown, Philadelphia, Pennsylvania.
- MILNE, FRANCIS F., Jr.**, 1714 Spruce Street, Philadelphia, Pennsylvania.
- MILNER, B. B.**, Engineer of Motive Power, in care of Frazer and Company, 30 Church Street, New York City, New York.
- MINER, HARLAN S.**, Chief Chemist, Welsbach Company, Gloucester, New Jersey.
- MISSIMER, GEORGE, JR.**, Farmer, West Port Royal Avenue, Roxborough, Philadelphia, Pennsylvania.
- MITCHELL, HENRY F.**, Glazed Kid Manufacturer, 36th and Reed Streets, Philadelphia, Pennsylvania.
- MITTEN, T. E.**, Chairman of Executive Committee, Philadelphia Rapid Transit Company, 1520 Spruce Street, Philadelphia, Pennsylvania.
- MIXER, CHARLES A.**, Engineer, Rumford Falls Power Company, Rumford, Maine.
- MODJESKI, RALPH**, Consulting Civil Engineer, 220 South Michigan Blvd., Chicago, Illinois.
- MOORE, ALFRED**, Attorney-at-Law, 618 North American Building, Philadelphia, Pennsylvania.
- MOORE, ALLEN J.**, Assistant Inspector of Ordnance, Navy Office, Bethlehem Steel Company, 511 South 6th Street, Allentown, Pennsylvania.
- MOORE, DAVID PELTON**, Patent Attorney, Warder Building, Washington, D. C.
- MOORE, HORACE E.**, Superintendent, 6429 Jefferson Street, Germantown, Philadelphia, Pennsylvania.
- MOORE, WALTER T.**, Foreign Freight Agent, 308 Bourse Building, Philadelphia, Pennsylvania.
- MOORE, W. E.**, Vice President and General Manager, West Penn Traction Company, Room 705, Union Bank Building, Pittsburgh, Pennsylvania.
- MORAN, ROBERT**, (Retired), Rosario, San Juan County, Washington.
- MORGAN, D. BRUCE**, Consulting Engineer, 805 Gotham National Bank Building, New York City, New York.
- MORGAN, MARSHALL S.**, Fidelity Trust Company, 325 Chestnut Street, Philadelphia, Pennsylvania.
- MORGAN, RANDAL**, First Vice President, United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- MORLEY, EDWARD W.**, Emeritus Professor of Chemistry, Western Reserve University, and for mail, West Hartford, Connecticut.
- MORRIS, A. SAUNDERS**, Mechanical Engineer, Haverford, Pennsylvania.
- MORRIS, EFFINGHAM B.**, Treasurer Committee of Public Safety, State of Pennsylvania, in care of Girard Trust Company, Philadelphia, Pennsylvania.
- MOYER, J. A.**, Director, Massachusetts Board of Education, State House, Boston, Massachusetts.
- MULLER, EDWARD ALBERT**, Vice President and Secretary, The King Machine Tool Company, and for mail, 839 Mitchell Avenue, Avondale, Cincinnati, Ohio.
- MULLER, RALPH H.**, Student of Chemical Engineering, University of Pennsylvania, and for mail, 1209 Rush Street, Philadelphia, Pennsylvania.
- MUNROE, Captain CHARLES W.**, (Retired), 205 Elm Avenue, Swarthmore, Pennsylvania.
- MURDOCK, JOSEPH B.**, Rear Admiral, U. S. N., (Retired), Danbury, New Hampshire.
- MURPHY, WALTER B.**, Manufacturing Manager, The Barrett Company, Chemical Department, Frankford, Philadelphia, Pennsylvania.
- MURRAY, B. L.**, Chemist, Merck and Company, Rahway, New Jersey.

- MURRAY, J. F., Assistant to Chief Engineer, Pennsylvania Railroad Company, 607 Broad Street Station, Philadelphia, Pennsylvania.
- MURRAY, THOMAS E., Consulting Electrical Engineer, 124 East 15th Street, New York City, New York.
- MURRAY, WILLIAM S., Consulting Engineer, 709 Sixth Avenue, New York City, New York.
- NAVARRO, JUSTO LOPEZ, Electrical Engineer, 121 Liguerrero, Ermita, Manila, Philippine Islands.
- NEEDLES, A. C., General Manager, Norfolk and Western Railway Company, Roanoke, Virginia.
- NEILER, SAMUEL G., Consulting Mechanical and Electrical Engineer, 1409 Manhattan Building, Chicago, Illinois.
- NELL, PHILIP, 3619 North Marshall Street, Philadelphia, Pennsylvania.
- NETHERY, JOHN E., (Retired), 3333 North Broad Street, Philadelphia, Pennsylvania.
- NEWBOLD, CLEMENT B., Banker, 511 Chestnut Street, Philadelphia, Pennsylvania.
- NICE, EUGENE E., Manufacturer, 272 South 2nd Street, Philadelphia, Pennsylvania.
- NICHOLS, CARROLL B., 1214 Widener Building, Philadelphia, Pennsylvania.
- NICHOLS, Dr. WILLIAM H., Chairman of Board of Directors, The Allied Chemical and Dye Corporation, 61 Broadway, New York City, New York.
- NORMAN, BRADFORD, Farmer, Newport, Rhode Island.
- NORMAN, REGINALD, Farmer, Newport, Rhode Island.
- NORRIS, GEORGE L., Tool Specialist, 222 West 2nd Street, Wilmington, Delaware.
- NORTH, R. H., North Brothers Manufacturing Company, Lehigh Avenue and American Street, Philadelphia, Pennsylvania.
- NORTHROP, EDWARD FITCH, Research Physicist, Palmer Physical Laboratory, Princeton, New Jersey.
- NOYES, STEPHEN H., Civil Engineer, Room 746, City Hall, Philadelphia, Pennsylvania.
- NUTTING, Dr. P. G., Director of Research, 848 First Street, Ocean City, New Jersey.
- OATLEY, H. B., Chief Engineer, Locomotive Superheater Company, 145 Wilson Avenue, Flushing, New York.
- OBERLY, ALBERT D., Civil Engineer, Scottsdale, Pennsylvania.
- OHMER, WILL I., President, Recording and Computing Machines Company, Dayton, Ohio.
- OLSEN, THORSTEN Y., Vice President and Treasurer, Tinius Olsen Testing Machine Company, 500 North 12th Street, Philadelphia, Pennsylvania.
- OLSEN, TINIUS, Mechanical Engineer, 500 North 12th Street, Philadelphia, Pennsylvania.
- ONNES, HEIKE KAMERLINGH, Physicist, University of Leiden, Leiden, Holland.
- ORROK, GEORGE A., Consulting Engineer, 17 Battery Place, New York City, New York, and for mail, R. F. D. No. 2, Willimantic, Connecticut.
- ORUM, MORRIS L., Manufacturer of Wood Working Machinery, 1320 North 19th Street, Philadelphia, Pennsylvania.
- OSBORNE, L. A., Vice President, Westinghouse Electric and Manufacturing Company, 165 Broadway, New York City, New York.
- OTIS, SPENCER, Manufacturer, Railway Exchange Building, Chicago, Illinois.
- OTT, G. F., President, George F. Ott Company, 325 Hansberry Street, Philadelphia, Pennsylvania.
- OUTERBRIDGE, ALEXANDER E., JR., Metallurgist, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- OWEN, BARTRAM ASHMEAD, Civil Engineer, 411 Pine Street, Philadelphia, Pennsylvania.
- PALMER, T. CHALKLEY, 2nd Vice President, American Dyewood Company, and for mail, Chester, Pennsylvania.
- PALMER, WALTER, Engineer, American Dyewood Company, and for mail, 105 West 23rd Street, Chester, Pennsylvania.
- PARDEE, CALVIN, Coal Operator, 447 Drexel Building, Philadelphia, Pennsylvania.
- PARISH, LE GRAND, President, American Arch Company, 30 Church Street, New York City, New York.
- PARKER, EDWARD W., Statistician and Economist, 437 Chestnut Street, Philadelphia, Pennsylvania.
- PARKER, JOHN C., in care of Lefax, Inc., Sheridan Building, Philadelphia, Pennsylvania.
- PARR, S. W., Professor of Applied Chemistry, 107 Chemistry Building, Urbana, Illinois.
- PARSONS, Sir CHARLES A., 6 Windsor Terrace, Newcastle-on-Tyne, England.
- PATTERSON, C. STUART, Banker, Western Saving Fund Society of Philadelphia, 1004 Walnut Street, Philadelphia, Pennsylvania.
- PATTERSON, FRANCIS D., Physician, Chief of Division of Industrial Hygiene and Engineering, Department of Labor and Industry, Harrisburg, and for mail, 3600 Grays Ferry Road, Philadelphia, Pennsylvania.
- PATTERSON, J. EDWARD, Vice President, Arthur H. Thomas Company, 230 South 7th Street, Philadelphia, Pennsylvania.

YEAR BOOK OF

- 1815 Land Title Building, Philadelphia, Pennsylvania.
- Consulting Engineer, 105 Liberty Building, Broad and Chestnut
Philadelphia, Pennsylvania.
- Manufacturer of Chemist's Supplies, Wheeling Steel Building, Wheeling, West
Virginia.
- JOSHUA A., Purchasing Agent, The United Gas Improvement Company, 1401
Philadelphia, Pennsylvania.
- Quintus, Pennsylvania Railroad Company, P. O. Box 503, Altoona, Penn-
sylvania.
- THOMAS G., Astronomical Engineer, Mt. Wilson Solar Observatory, Pasadena, Cali-
fornia.
- President, Personnel Department Pennsylvania System, Broad Street Station,
Philadelphia, Pennsylvania.
- TOP HENRY E., Student, 1008 Clinton Street, Philadelphia, Pennsylvania.
- JOHN C., Pennie, Davis, Marvin & Edmunds, Counsellors-at-Law, 165 Broadway,
New York City, New York.
- GEO L., Florist, 165 West Essex Avenue, Lansdowne, Pennsylvania.
- CHARLES, Electrical Engineer, in care of Day and Zimmerman, 611 Chestnut
Philadelphia, Pennsylvania.
- F A F, JR., Geologist, 460 Bullitt Building, Philadelphia, Pennsylvania.
- DAVID, Engineer, Commonwealth Building, Philadelphia, Pennsylvania.
- MORRIS, JR., Malt Manufacturer, 808 Lafayette Building, Philadelphia, Penn-
sylvania.
- EMILE, G., Architect and Engineer, Boyertown Building, 1211 Arch Street Phila-
delphia, Pennsylvania.
- ROBERT S., President, Franklin H. Kalbfleish Company, 31 Union Square, West,
New York City, New York.
- INGO, General JOHN J., War Department, Washington, D. C.
- HOWARD, President, Sun Oil Company, and Sun Shipbuilding Company, Finance
Building, Philadelphia, Pennsylvania.
- HUNTER C., 651 Salem Avenue, Dayton, Ohio.
- EDWINS, President, Philbrin Corporation, Kennett Square, Pennsylvania.
- LUCIEN E., The Franklin Institute, Philadelphia, Pennsylvania.
- C. A., Electrical Engineer, Wm. Cramp & Sons Ship and Engine Building Company,
Philadelphia, Pennsylvania.
- Brig. General, JOHN, (Retired) 167 Berkeley Avenue, Orange, New Jersey.
- W. L., Architect and Structural Engineer, S. W. Corner 12th and Locust Streets,
Philadelphia, Pennsylvania.
- H. H., Mechanical Engineer, Scarsdale, New York.
- RALPH W., Honorary Secretary, American Institute of Electrical Engineers, 570
Henry Street, Elizabeth, New Jersey.
- J. BENTON, Electrical Engineer, 1527 Spruce Street, Philadelphia, Pennsylvania.
- ROLAND G., Gas Engineer, Swarthmore, Pennsylvania.
- Dr. M., 16 Vick Park B, Rochester, New York.
- THWAITE, C. E., General Sales Manager, Pressed Steel Car Company, 55 Broad
Street, New York City, New York.
- JOSHUA R. H., Attorney-at-Law, 929 Chestnut Street, Philadelphia, Pennsylvania.
- WILLIAM M., Civil Engineer, Wyebrooke, Chester County, Pennsylvania.
- CARL D., Chemist, 412 West Broad Street, Tamaqua, Pennsylvania.
- ERGAST, A. P., Mechanical Superintendent, Texas and Pacific Railway Company,
General Office Building, Dallas, Texas.
- MAX CHARLES, Architect, Punta Gorda, Florida.
- MORTON MOORE, Sales Agent, The Babcock and Wilcox Company, 1010 North
American Building, Philadelphia, Pennsylvania.
- J. JOHN, Assistant to Vice President, Atchison, Topeka and Santa Fe Railway Com-
pany, 80 East Jackson Boulevard, Chicago, Illinois.
- WALTER J., Physician, 1931 Chestnut Street, Philadelphia, Pennsylvania.
- R., General Superintendent of Motive Power and Car Departments, Chicago and
Northwestern Railway Company, Station E., Chicago, Illinois.
- Y, HENRY H., Consulting Structural Engineer, 3920 Girard Avenue, Philadelphia,
Pennsylvania.
- C. H., Chief Electrical Engineer, Norfolk and Western Railway Company, Roanoke,
Virginia.
- ED, ROBERT, Manufacturer, 1103 Morris Building, Philadelphia, Pennsylvania.
- HN, Shop Engineer, Bement-Miles Works, Miles-Bement-Pond Company, and for
all, 4945 Larchwood Avenue, Philadelphia, Pennsylvania.

- RAMSEY, GEORGE W., Patent Attorney, Woolworth Building, New York City, New York
- RAPP, I. M., Physicist, R. D. 3, Phoenixville, Pennsylvania.
- RAUTENSTRAUCH, WALTER, Professor of Mechanical Engineering, 43 Exchange Place, New York City, New York.
- RAYMOND, WARD, Mechanical Engineer, 908 Paxinosa Avenue, Easton, Pennsylvania.
- REA, SAMUEL, President, Pennsylvania Railroad Company, Broad Street Station, Philadelphia, Pennsylvania.
- REATH, THEODORE, Attorney-at-law, 1201 Commercial Trust Building, Philadelphia Pennsylvania.
- REBER, COLONEL SAMUEL, 27 Van Dum Street, New York City, New York.
- REBMANN, G. R., Vice President, Otis Elevator Company, 16th & Sansom Streets, Philadelphia Pennsylvania.
- REDFIELD, ROBERT S., Wayne, Pennsylvania.
- REED, G. BERKELEY, Inventor, 80 St. James Place, Brooklyn, New York.
- REED, HOMER, JR., Banker, Engineering Department, Chandler and Company, Bankers, 700 Franklin Bank Building, Philadelphia, Pennsylvania.
- REESE, CHARLES L., Chemical Engineer, E. I. du Pont de Nemours & Company, Wilmington, Delaware.
- REICHARDT, HENRY, (Retired), 3581 Queen Lane, East Falls, Philadelphia, Pennsylvania.
- RENO, JESSE W., Consulting Engineer, 684 St. Nicholas Avenue, New York City, New York.
- REOCH, ALEXANDER ERNEST, Electrical Engineer, The Radio Corporation of America, 233 Broadway, New York City, New York.
- RESINES, JAVIER, Industrial Chemist, Racquet Club, Philadelphia, Pennsylvania.
- RHOADS, J. J., Superintendent, Pennsylvania Railroad Company, 407 West 2nd Street, Oil City, Pennsylvania.
- RICE, E. W., JR., Electrical Engineer, President, General Electric Company, Schenectady, New York.
- RICE, CHARLES D., Manager of Factory, Underwood Typewriter Company, 581 Capitol Avenue, Hartford, Connecticut.
- RICHARDS, EDGAR, Retired Chemist, 60 Ayrault Street, Newport, Rhode Island.
- RICHARDS, J. W., Professor of Metallurgy, Lehigh University, Bethlehem, Pennsylvania.
- RICHARDS, THEODORE WM., Director, Wolcott Gibbs Memorial Laboratory, Harvard University, Cambridge, Massachusetts.
- RICHARDSON, CHARLES E., Engineer, Chas. E. Richardson and Company, Engineers, 18 East 60th Street, New York City, New York.
- RICHMOND, WILLIAM, H., Retired Coal Operator, Richmond Villa, 1718 Capouse Avenue, Scranton, Pennsylvania.
- RICKETTS, L. D., Mining Engineer, Warren, Arizona.
- RIDGWAY, ELLIS B., Manufacturer, 367 West Main Street, Coatesville, Pennsylvania.
- RIDGWAY, ROBERT, Engineer, in care of Public Service Company, 49 Lafayette Street, New York City, New York.
- RIDWAY, WILLIAM H., Civil Engineer and Manufacturer, The Craig Ridway and Son Company, Coatesville, Pennsylvania.
- RIEHLE, FRED A., Testing Machine Manufacturer, 1424 North 9th Street, Philadelphia, Pennsylvania.
- RIGLING, ALFRED, Librarian, The Franklin Institute, and for mail, 4835 Haverford Avenue, Philadelphia, Pennsylvania.
- RILEY, LEWIS A., Civil and Mining Engineer, Lafayette Building, 437 Chestnut Street, Philadelphia, Pennsylvania.
- RILLIET, CHARLES E., Teacher, 4100-06 South Vermont Avenue, Los Angeles, California.
- RINGWALT, ROLAND, Clergyman, 3016 Carman Street, Camden, New Jersey.
- RITTENHOUSE, EDWARD, Chemical Engineer, Aldam, Pennsylvania.
- RITTER, LOUIS E., Consulting Civil Engineer, 1707 Marquette Building, Chicago, Illinois.
- RITTMAN, Dr. W. F., Chemical Engineer, Salem, Ohio.
- ROBB, RUSSELL, Member of Firm, Stone and Webster Engineering Corporation, 147 Milk Street, Boston, Massachusetts.
- ROBERTS, WILMER, Palmyra, New Jersey.
- ROBINSON, ANTHONY W., Insurance, 409 Chestnut Street, Philadelphia, Pennsylvania.
- ROBINSON, DWIGHT P., Consulting Engineer, 49 East 52nd Street, New York City, New York.
- ROBINSON, EDMUND G., Chemist, 909 Nottingham Road, Wilmington, Delaware.
- RODMAN, HUGH, Engineer and Manufacturer, in care of Rodman Chemical Company, Verona, Pennsylvania.

- ROESSLER, FRANK, Manufacturing Chemist, 89 High Street, Perth Amboy, New Jersey.
- ROGERS, ALLEN, Teacher, Pratt Institute, Brooklyn, New York.
- ROGERS, MRS. AUGENE P., 4007 Powelton Avenue, Philadelphia, Pennsylvania.
- ROGERS, FRANK H., Mechanical Engineer, William Cramp and Sons, Ship and Engine Building Company, Philadelphia, Pennsylvania.
- ROGERS, JAMES S., Attorney-at-Law, 701 Commonwealth Trust Building, Philadelphia, Pennsylvania.
- ROLLE, SYLVAN D., Draftsman, The Bell Telephone Company of Pennsylvania, and for mail, 2143 North 19th Street, Philadelphia, Pennsylvania.
- ROLLER, FRANK W., Electrical and Mechanical Engineer, 233 Broadway, New York City, New York.
- RONDINELLA, L. F., Professor of Drawing and Designing, West Philadelphia High School for Boys, 48th and Walnut Streets, Philadelphia, Pennsylvania.
- ROSENBAUM, MORRIS, Foreign Exchange, 605 South 3rd Street, Philadelphia, Pennsylvania.
- ROSENBAUM, W. A., Patent Attorney, 41 Park Row, New York City, New York.
- ROSENGARTEN, FRANK H., Chemist, 1905 Walnut Street, Philadelphia, Pennsylvania.
- ROSENGARTEN, FREDERIC, Manufacturing Chemist, P. O. Box 1625, Philadelphia, Pennsylvania.
- ROSENGARTEN, GEORGE D., Manufacturing Chemist, P. O. Box 1625, Philadelphia, Pennsylvania.
- ROSIN, JOSEPH, Chemist, Powers-Weightman-Rosengarten Company, 9th and Parrish Streets, Philadelphia, Pennsylvania.
- ROSS, T. EDWARD, Certified Public Accountant, 1209 Morris Building, Philadelphia, Pennsylvania.
- ROWLAND, CHARLES B., Vice President, Continental Iron Works, West and Calyer Streets, Brooklyn, New York.
- RUGG, W. S., The University Club, 4439 Grant Boulevard, Pittsburgh, Pennsylvania.
- RUMBOUGH, J. B., Consulting Mechanical Engineer, P. O. Box 224, Reno, Nevada.
- RUMELY, W. N., 3020 Sheridan Road, Chicago, Illinois.
- RUMFORD, WM. C., Address unknown.
- RUSBY, J. M., Engineer of Tests, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- RUSSELL, CHARLES J., Manager, Sales Department, The Philadelphia Electric Company, 10th and Chestnut Streets, Philadelphia, Pennsylvania.
- SADTLER, Dr. SAMUEL P., Consulting Chemist, 210 South 13th Street, Philadelphia, Pennsylvania.
- SADTLER, SAMUEL S., Consulting Chemist, 210 South 13th Street, Philadelphia, Pennsylvania.
- SAEGMULLER, G. N., Vice President, in care of Bausch and Lomb Optical Company Rochester, New York.
- SALMON, FREDERICK W., Civil and Mechanical Engineer, Richmond, Virginia.
- SALOM, PEDRO G., Electro-Chemical Engineer, Commonwealth Trust Building, Philadelphia, Pennsylvania.
- SAMUEL, J. BUNFORD, Retired Iron Merchant, 1609 Spruce Street, Philadelphia, Pennsylvania.
- SANBORN, EDWARD H., Coal Mining, 1100 Commercial Trust Building, Philadelphia, Pennsylvania.
- SANDERSON, R. P. C., in care of The Baldwin Locomotive Works, 34 Victoria Street, London, England.
- SANDT, A. R., Consulting Engineer, 716-18 Metropolitan Life Building, Minneapolis, Minnesota.
- SANFORD, RUFUS H., Librarian, The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- SARGENT, C. E., Chief Engineer, Lyons Atlas Company, 2020 North Delaware Street, Indianapolis, Indiana.
- SARGENT, HENRY B., Hardware Manufacturer, 247 Church Street, New Haven, Connecticut.
- SARTAIN, PAUL J., Physician, 2006 Walnut Street, Philadelphia, Pennsylvania.
- SARTAIN, WILLIAM, Artist, 140 West 57th Street, New York City, New York.
- SATTERTHWAITE, GEORGE, Manufacturer of Steel, in care of Tacony Steel Company, Tacony, Philadelphia, Pennsylvania.
- SAUER, FRANK H., Draftsman, 1307 Atlantic Avenue, Camden, New Jersey.
- SAUNDERS, WALTER M., Analytical and Consulting Chemist, 20 Dewey Street, Olneyville, Providence, Rhode Island.
- SAWELLE, WILLIAM OTIS, Professor of Physics, Haverford College, Haverford, Pennsylvania.
- SCATTERGOOD, HENRY W., Manufacturer, 503 Land Title Building, Philadelphia, Pennsylvania.
- SCHAEFER, GEORGE F., 5th and Cherry Streets, Philadelphia, Pennsylvania.

- SCHEHL, OSCAR L., Mechanical Engineer, 1631 Girard Avenue, Philadelphia, Pennsylvania.
- SCHLAFGE, WILLIAM S., General Mechanical Superintendent, Erie Railroad Company, 50 Church Street, New York City, New York.
- SCHLICKE, C. P., Treasurer and Secretary, 31 Plaza Street, Brooklyn, New York.
- SCHROM, OSCAR G., Mechanical Engineer, 6017 Nassau Street, Philadelphia, Pennsylvania.
- SCOTT, WM. M., Draftsman, Box 76, Radnor, Pennsylvania.
- SEELY, LESLIE B., Teacher, 5918 Pulaski Avenue, Germantown, Philadelphia, Pennsylvania.
- SEIBERLING, F. A., Manufacturer, 1144 East Market Street, Akron, Ohio.
- SELGA, M., Manila Observatory, Manila, Philippine Islands.
- SELLERS, ALEXANDER, Manufacturer, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- SELLERS, COLEMAN, JR., Mechanical Engineer, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- SELLERS, HORACE W., Architect, Ardmore, Pennsylvania.
- SELLERS, HOWARD, Millbourne House, Millbourne, Pennsylvania.
- SELLERS, RICHARD, Bellevue, Delaware.
- SELLERS, RICHARD C., Civil Engineer, Swarthmore, Pennsylvania.
- SELLERS, MRS. WILLIAM, Bellevue, Delaware.
- SELLERS, WILLIAM F., Manufacturer of Water Tube Boilers, Edge Moor, Delaware.
- SEVERY, MELVIN L., Inventor and Author, 431 South Berendo Street, Los Angeles, California.
- SHACKELFORD, BENJAMIN E., Physicist, Westinghouse Lamp Company, Bloomfield, New Jersey.
- SHAND, A. C., Civil Engineer, Narberth, Pennsylvania.
- SHARER, CARL W., Superintendent of Equipment, The Keystone Telephone Company, and for mail, 446 East Walnut Lane, Germantown, Philadelphia, Pennsylvania.
- SHARP, Dr. CLAYTON H., Technical Director, Electrical Testing Laboratories, 80th Street and East End Avenue, New York City, New York.
- SHARP, W. H., Paper Manufacturer, The Wellington, 19th and Walnut Streets, Philadelphia, Pennsylvania.
- SHARPLES, STEPHEN P., Chemical Engineer, 22 Concord Avenue, Cambridge, Massachusetts.
- SHATTUCK, A. F., Chief Chemist, Solvay Process Company, and for mail, 615 Canon Drive, Beverly Hills, California.
- SHATTUCK, JOHN D., Gas Engineer, Chester, Pennsylvania.
- SHEARD, Dr. CHARLES, Editor, The American Journal of Physiological Optics, Southbridge, Massachusetts.
- SHERWOOD, L. T., Chemist, P. O. Box 196, Carney's Point, New Jersey.
- SHIMER, PORTER W., Chemist and Metallurgist, Easton, Pennsylvania.
- SHMIDHEISER, W. A., Mechanical Engineer, The Bell Telephone Company of Pennsylvania and for mail, 6017 Pine Street, Philadelphia, Pennsylvania.
- SHOEMAKER, SAMUEL, Builder and Real Estate, 1132 Land Title Building, Philadelphia, Pennsylvania.
- SHOEMAKER, THOMAS H., (Retired), 120 West Tulpehocken Street, Germantown, Philadelphia, Pennsylvania.
- SILLCOX, LEWIS K., Mechanical and Electrical Engineer, Herrick Road, Box 570, Riverside, Illinois.
- SILLIMAN, FRANK, JR., Engineer and Manager, 5987 Woodbine Avenue, Overbrook, Philadelphia, Pennsylvania.
- SIMSOHN, JULIAN STERN, Chemist, S. E. corner Broad Street and Girard Avenue, Philadelphia, Pennsylvania.
- SINKLER, JOHN P. B., Architect, 412 Otis Building, 112 South 16th Street, Philadelphia, Pennsylvania.
- SKINNER, C. E., Engineer, Research Division, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania.
- SKINNER, H. J., Chemical Engineer, Vice President, Arthur D. Little, Incorporated, 71 West Chestnut Street, Wakefield, Massachusetts.
- SKINNER, ORVILLE CAMPBELL, Metallurgical Engineer, Superintendent, Standard Steel Works, Burnham, Pennsylvania.
- SLATER, HOWARD C., Mechanical Engineer, P. O. Box 332, Ridley Park, Pennsylvania.
- SMALLING, ELMER, JR., Student, 2930 North Camac Street, Philadelphia, Pennsylvania.
- SMITH, A. D. W., Mining Engineer, Coal Exchange Building, Wilkes-Barre, Pennsylvania.
- SMITH, ALBERT W., Professor of Industrial Chemistry, Case School of Applied Science, and for mail, 11333 Bellflower Road, Cleveland, Ohio.
- SMITH, A. T., in care of The Permutit Company, 440 Fourth Avenue, New York City, New York.

- SMITH, AUGUSTUS**, Civil Engineer, Elizabeth, R. F. D. No. 2, New Jersey.
- SMITH, EDWARD W.**, Chemical Engineer, 735 East Penn Street, Germantown, Philadelphia, Pennsylvania.
- SMITH, FRANK W.**, Vice President and General Manager, The United Electric Light and Power Company, 130 East 15th Street, New York City, New York.
- SMITH, HERBERT S. S.**, Professor of Civil Engineering, Princeton University, and for mail, P. O. Box 161, Princeton, New Jersey.
- SMITH, IRVING B.**, Chief of Research Department, Leeds and Northrup Company, and for mail, Ambler, Pennsylvania.
- SMITH, J. WALDO**, Chief Engineer, Board of Water Supply, City of New York, Municipal Building, New York City, New York.
- SMITH, LESLIE DENIS**, Color Investigation Laboratory, Bureau of Chemistry, U. S. Dept. of Agriculture, Washington, D. C.
- SMITH, N. W.**, Superintendent, Middle Division, Pennsylvania Railroad Company, Altoona, Pennsylvania.
- SMITH, OBERLIN**, Mechanical Engineer and Manufacturer, in care of Ferracute Machine Company, Bridgeton, New Jersey.
- SMITH, P. F., JR.**, Manager, Altoona Works, Pennsylvania System, Altoona, Pennsylvania.
- SMITH, S. D.**, Machinist, 1616 North Redfield Street, Philadelphia, Pennsylvania.
- SMITH, WALTER B.**, Builder, 6490 Woodbine Avenue, Overbrook, Philadelphia, Pennsylvania.
- SMITH, W. HINCKLE**, Banker, Bryn Mawr, Pennsylvania.
- SMITH, W. LEHIGH**, Chemist, The Viscose Company, Box 171, Marcus Hook, Pennsylvania.
- SNELLENBURG, SAMUEL**, Merchant, Market in care of Twelfth Streets, Philadelphia, Pennsylvania.
- SNELLING, WALTER O.**, Research Chemist, 208 North 5th Street, Allentown, Pennsylvania.
- SNOOK, H. CLYDE**, Electrical Engineer, c/o Western Electric Company, 463 West Street, New York City, New York.
- SNYDER, CLINTON F.**, Chemist, Minersville, Pennsylvania.
- SNYDER, Professor MONROE B.**, Teacher and Astronomer, 111 Grand View Road, Ardmore, Pennsylvania.
- SOULAS, CHARLES W.**, Hotel Proprietor, 1108 Sansom Street, Philadelphia, Pennsylvania.
- SOUTHALL, JAMES P. C.**, Associate Professor of Physics, Columbia University, New York City, New York.
- SPACKMAN, H. S.**, President, Henry S. Spackman Engineering Company, 2024 Arch Street, Philadelphia, Pennsylvania.
- SPARKS, THOMAS W.**, Trustee of Estates, 4100 Walnut Street, Philadelphia, Pennsylvania.
- SPARRE, FIN**, Chemist, E. I. du Pont de Nemours and Company, Room 450, du Pont Building, Wilmington, Delaware.
- SPENCER, H. B.**, President, Fruit Growers' Express Company, Munsey Building, Washington, D. C.
- SPENCER, PAUL**, Electrical Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- SPENCER, THOMAS**, Engineer, 3523 Balsam Avenue, Indianapolis, Indiana.
- SPERR, F. W., JR.**, Chief Chemist, H. Koppers Company Laboratory, Mellon Institute, Pittsburgh, Pennsylvania.
- SPERRY, ELMER A.**, Engineer, The Sperry Gyroscope Company, Sperry Building, Manhattan Bridge Plaza, Brooklyn, New York.
- SPICER, H. N.**, Metallurgical Engineer, The Architects Building, 101 Park Avenue, New York City, New York.
- SPITZ, SAMUEL**, Inventor, 372 Bellevue Avenue, Oakland, California.
- SPITZGLASS, J. M.**, Mechanical Engineer, 2240 Diversey Boulevard, Chicago, Illinois.
- SPRAGUE, FRANK J.**, Consulting Engineer, President, Sprague Safety Control & Signal Corporation, 421 Canal Street, New York City, New York.
- SPRONG, S. D.**, Electrical Engineer, Brooklyn Edison Company, 360 Pearl Street, Brooklyn, New York.
- SPRUANCE, W. C.**, Vice President, in Charge of Production Department, E. I. du Pont de Nemours and Company, and for mail, 2507 West 17th Street, Wilmington, Delaware.
- SQUIER, GEORGE OWEN**, Major General, Chief Signal Officer, U. S. Army, K. C. M. G., D. S. C., War Department, Washington, D. C.
- STANFORD, H. R.**, Civil Engineer, Naval Operating Base, Hampton Roads, Norfolk, Virginia.
- STANLEY, FRANK A.**, Editor, East Auburn, California.
- STEEL, JOSEPH M.**, Building Constructor, 1600 Arch Street, Philadelphia, Pennsylvania.
- STEIN, A.**, Manufacturer, 97 Gold Street, New York City, New York.
- STEINMETZ, CHARLES P.**, Chief Consulting Engineer, General Electric Company, and Professor of Electro-Physics, Union College, and for mail, Wendell Avenue, Schenectady, New York.

- STEINMETZ, JOSEPH ALLISON**, Designer, Janney, Steinmetz and Company, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- STEINMETZ, SPENCER J.**, 31 Evans Road, Brookline, Massachusetts.
- STEUER, HENRY J.**, Chemist, 509 South 10th Street, Philadelphia, Pennsylvania.
- STEVENS, F. S.**, Engineer Maintenance of Way, Philadelphia and Reading Railway Company and for mail, 540 North 5th Street, Reading, Pennsylvania.
- STEVENS, JOHN S.**, 9th Street and Montgomery Avenue, Philadelphia, Pennsylvania.
- STEVENSON, D. A. R., Jr.**, Electrical Engineer, General Electric Company, 6 Union Street, Schenectady, New York.
- STEVENSON, S. PRICE**, Manufacturer of Coal Storage Doors, 1500 West 4th Street, Chester Pennsylvania.
- STEWART, FRANK H.**, Dealer in Electrical Supplies, Old Mint Building, Philadelphia, Pennsylvania.
- STEWART, FRANK H.**, Textile Manufacturer, in care of Krout and Fite Manufacturing Company, 1950 East Allegheny Avenue, Philadelphia, Pennsylvania.
- STEWART, RALPH C.**, Attorney-at-Law, 803 West End Trust Building, Philadelphia, Pennsylvania.
- STEWART, THOMAS S.**, Physician, 18th and Spruce Streets, Philadelphia, Pennsylvania.
- STILLWELL, L. B.**, Consulting Engineer, 143 Liberty Street, New York City, New York.
- STINE, WILBUR M.**, Author, 334 West Main Street, Mechanicsburg, Pennsylvania.
- STITZER, A. B.**, Chief Engineer, Republic Engineers, Incorporated, 60 Broadway, New York City, New York.
- STOETZ, HOWARD**, Chemist, Electric Storage Battery Company, and for mail, 4741 Rosehill Street, Philadelphia, Pennsylvania.
- STOKES, FRANCIS J.**, Machinery Manufacturer, 17th and Cambria Streets, Philadelphia, Pennsylvania.
- STONE, CHARLES A.**, Engineer, Member of Firm of Stone and Webster Engineering Corporation, 147 Milk Street, Boston, Massachusetts.
- STONE, C. W.**, Electrical Engineer, General Electric Company, Schenectady, New York.
- STONE, JOHN**, Consulting Electrical Engineer, 4811 Panorama Street, San Diego, California.
- STOTESBURY, E. T.**, Banker, Chestnut and Fifth Streets, Philadelphia, Pennsylvania.
- STOUGHTON, A. B.**, Attorney-at-Law, 1506 Land Title Building, Philadelphia, Pennsylvania.
- STOUT, ORIN C.**, Hydraulic and Sanitary Engineer, Chillicothe, Barr County, Ohio.
- STRADLING, Dr. G. F.**, Teacher, Principal Northeast High School, and for mail, 5120 Newhall Street, Germantown Philadelphia, Pennsylvania.
- STRONG, WILLIAM WALKER**, Consulting Physicist, 500 South York Street, Mechanicsburg, Cumberland County, Pennsylvania.
- STROUD, EDWARD A.**, Florist, 508 South 41st Street, Philadelphia, Pennsylvania.
- STUTZ, ERNEST**, Representative for Foreign Patents, 1705 Hope Street, South Pasadena, California.
- STYRI, Dr. HAALSON**, Chief Chemist, S. H. F. Research Laboratory, Front Street & Erie Avenue, Philadelphia, Pennsylvania.
- SUCZEK, ROBERT**, Mechanical Engineer, C. H. Wheeler Manufacturing Company, 18th Street and Lehigh Avenue, Philadelphia, Pennsylvania.
- SULZNER, CHARLES F.**, (Retired), 630 14th Street, Miami, Florida.
- SUPPLEE, WM. H.**, Factory Manager, 211 South 12th Street, Philadelphia, Pennsylvania.
- SUTTON, FRANK W.**, Industrial Engineer, Charles E. Bedaux Company, 4500 Euclid Avenue, Cleveland, Ohio.
- SWEET, H. N.**, Banker, 63 Mt. Vernon Street, Boston, Massachusetts.
- SWENSON, MAGNUS**, President and Treasurer, Southern Wisconsin Power Company, Madison, Wisconsin.
- SYKES, JOHN P.**, The Baldwin Locomotive Works, Broad and Spring Garden Streets, Philadelphia, Pennsylvania.
- SYMONS, WILSON E.**, Consulting Engineer, Galena-Signal Cil Company, 41 East 42nd Street, New York City, New York.
- SYNNESTVEDT, ARTHUR**, Student, Bryn Athyn, Pennsylvania.
- TABER, GEORGE H.**, Vice President, Gulf Refining Company, P. O. Box 1214, Pittsburgh, Pennsylvania.
- TAGGART, WALTER T.**, Professor of Chemistry, University of Pennsylvania, Philadelphia, Pennsylvania.
- TAIT, EDWARD H.**, Superintendent, 401 Brighter Apartments, Second & Penn Streets, Reading, Pennsylvania.
- TAIT, F. M.**, 80 Broadway, New York City, New York.
- TAKAMINE, JOKICHI**, Research Chemist, Equitable Building, New York City, New York.
- TALBOT, H. P.**, Professor of Inorganic Chemistry, Massachusetts Institute of Technology, Boston, Massachusetts.

- TATE, ALFRED O.**, President, Tate Electrolytic Textile Processes, Incorporated, Cranston, Rhode Island.
- TATNALL, Dr. ROBERT R.**, Research Engineer, J. E. Rhoads and Sons, Wilmington, Delaware.
- TAWS, LOUIS**, (Retired), 6654 Lincoln Drive, Germantown, Philadelphia, Pennsylvania.
- TAYLOR, DAVID WATSON**, Rear Admiral, Chief, Bureau of Construction and Repair, Navy Department, Washington, D. C.
- TAYLOR, EDWARD B.**, Vice President, Pennsylvania Lines West of Pittsburgh, 901 Pennsylvania Station, Pittsburgh, Pennsylvania.
- TAYLOR, HOLLINSHEAD N.**, Tinplate Manufacturer, 300 Chestnut Street, Philadelphia, Pennsylvania.
- TAYLOR, LOWNDES**, Route No. 1, P. O. Box 3, West Chester, Pennsylvania.
- TEEPLE, JOHN E.**, Consulting Chemist and Chemical Engineer, 50 East 41st Street, New York City, New York.
- TEMPLE, EDWARD B.**, Swarthmore, Pennsylvania.
- THAMM, CHARLES G. A.**, Clerk, 1526 Glenwood Avenue, Philadelphia, Pennsylvania.
- THOMAS, ARTHUR H.**, Laboratory Appliances, West Washington Square, Philadelphia, Pennsylvania.
- THOMAS, C. C.**, Professor of Mechanical Engineering, Dwight P. Robinson and Company, Electric Equipment Building, 1240 South Hope Street, Los Angeles, California.
- THOMPSON, ARTHUR W.**, President, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.
- THOMPSON, CHARLES T.**, 426 Walnut Street, Philadelphia, Pennsylvania.
- THOMPSON, HUGH L.**, Consulting Engineer, Waterbury, Connecticut.
- THOMPSON, PAUL, N. W.** cor. Broad and Arch Streets, Philadelphia, Pennsylvania.
- THOMPSON, ELIHU**, Electrical Engineer, 22 Monument Avenue, Swampscott, Massachusetts.
- THORNE, WILLIAM H.**, Mechanical Engineer, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- TIDDY, WILLIAM**, Chief Chemist, Rainey-Wood Coke Company, Swedeland, Pennsylvania.
- TIEMANN, HUGH P.**, Metallurgical Engineer, Carnegie Steel Company, Pittsburgh, Pennsylvania.
- TIERNEY, L. E.**, Coal Operator, Powhatan, West Virginia.
- TIGERSTEDT, A. F.**, General Director, Board of Trade, Helsingfors, Finland.
- TILGHMAN, B. C.**, Manufacturer, Highfield, Dunham Road, Altrincham, Cheshire, England.
- TITZEL, R. JOHN**, Gas Engineer, Hamilton Apartments, Norristown, Pennsylvania.
- TOCH, MAXIMILIAN**, Paint Manufacturer, Director, Research Laboratory, Toch Brothers, 320 Fifth Avenue, New York City, New York.
- TOLMAN, L. M.**, Chemist, 7217 Yale Avenue, Englewood Station, Chicago, Illinois.
- TORCHIO, PHILIP**, Chief Electrical Engineer, The New York Edison Company, Irving Place and 15th Street, New York City, New York.
- TOULMIN, H. A., JR.**, Patent Attorney, 901 Schwind Building, Dayton, Ohio.
- TOWNE, HENRY R.**, Mechanical Engineer, 420 Park Avenue, New York City, New York.
- TOWNEND, R. V.**, Research Chemist, Victor Talking Machine Company, Camden, New Jersey.
- TOWNSEND, JOHN SEALY**, Professor of Physics, New College, Oxford, England.
- TOWNSEND, J. W.**, 825 Montgomery Avenue, Bryn Mawr, Pennsylvania.
- TRAUTWINE, JOHN C., JR.**, Civil Engineer, 257 South 4th Street, Philadelphia, Pennsylvania.
- TRAUTWINE, JOHN C., 3rd.**, Civil Engineer, Box 6509, Upper Darby Branch, Philadelphia, Pennsylvania.
- TREXLER, HARRY C.**, Colonel, President, Lehigh Portland Cement Company, Allentown, Pennsylvania.
- TRUEMAN, WILLIAM H.**, Dentist, 47 High Street, Germantown, Philadelphia, Pennsylvania.
- TSCHUDY, EARL H.**, Teacher in High School, 613 Canal Street, Lebanon, Pennsylvania.
- TURNER, WILLIAM JAY**, Attorney-at-Law, Lycoming, School House Lane, Germantown, Philadelphia, Pennsylvania.
- TUTWILER, C. C.**, Consulting Gas Chemist, West Conshohocken, Pennsylvania.
- TWINING, WM. STANTON**, Civil Engineer, 119 Harvey Street, Germantown, Philadelphia, Pennsylvania.
- TYSON, H. P.**, Collegeville, Pennsylvania.
- UEHLING, E. A.**, Mechanical Engineer, 3226 McKinley Building, Milwaukee, Wisconsin.
- ULMER, CARL D.**, Chemist, Minnesota By-Product Coke Company, 1000 Hamline Avenue, St. Paul, Minnesota.
- UNDERWOOD, FREDERICK D.**, President, Erie Railroad Company, 50 Church Street, New York City, New York.
- UNWIN, WILLIAM CAWTHORNE**, Civil Engineer, Palace Gate Mansions, Kensington, London, England.

- VAIL, JAMES G.**, Chief Chemist, Philadelphia Quartz Company, 121 South 3rd Street, Philadelphia, Pennsylvania.
- VALASEK, J.**, Physicist, 1117 7th Street, S. E., Minneapolis, Minnesota.
- VAN DER LINGEN, J. STEPHEN**, Physical Laboratory, Johns Hopkins University, Baltimore, Maryland.
- VAN DEVENTER, CHRISTOPHER**, Consulting Engineer, 438 First National Bank Building, Chicago, Illinois.
- VAN DEVENTER, H. R.**, Engineer and Patent Attorney, Bureau Patent Development, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania.
- VAN DYKE, J. W.**, President, The Atlantic Refining Company, The Wellington, Philadelphia, Pennsylvania.
- VAN TRUMP, S. N.**, Civil Engineer, Water Department, Wilmington, Delaware.
- VAUCLAIN, S. M.**, President, The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- VAUGHAN, H. H.**, Engineer, 20 MacGregor Street, Montreal, Quebec, Canada.
- VAUGHEN, F. G.**, Sales Manager, Meter Department, General Electric Company, Schenectady, New York.
- VAUX, GEORGE, JR.**, Attorney-at-Law, Gulf Road, Bryn Mawr, Pennsylvania.
- VEEDER, CURTIS H.**, Manufacturer, Veeder Manufacturing Company, Hartford, Connecticut.
- VIAL, ETHEAN**, Editor, Barbourville, Kentucky.
- VOGLESON, JOHN A.**, Civil Engineer, 8009 Crefeldt Street, Philadelphia, Pennsylvania.
- VON KLEINSMID, R. B.**, President, University of Arizona, Tucson, Arizona.
- VREELAND, FREDERICK R.**, Research Engineer, 90 West Street, New York City, New York.
- WADDELL, J. A. L.**, Consulting Engineer, 35 Nassau Street, New York City, New York.
- WADLEIGH, F. R.**, Assistant to President, Tuttle Corporation, 15 Broad Street, New York City, New York.
- WADSWORTH, F. L. O.**, Consulting and Advisory Engineer, P. O. Box 1, East Liberty Station Pittsburgh, Pennsylvania.
- WAGNER, FRED H.**, Chief Engineer, The Bartlett Hayward Company, and for mail, Lombardy Apartments, 39th Street and Stony Run Lane, Baltimore, Maryland.
- WAGNER, HERBERT A.**, President, Consolidated Gas Electric Light and Power Company, Lexington and Liberty Streets, Baltimore, Maryland.
- WAGNER, SAMUEL T.**, Chief Engineer, Philadelphia and Reading Railway Company, and for mail, School House Lane, Germantown, Philadelphia, Pennsylvania.
- WALDRON, WILLIAM H.**, Manufacturer of Machinery, John Waldron Company, New Brunswick, New Jersey.
- WALKER, J. W.**, Manufacturer, Address unknown.
- WALLER, ALFRED E.**, Electrical Engineer, Lawrence Park, Bronxville, New York.
- WALLERSTEIN, LEO**, Chemist, 171 Madison Avenue, New York City, New York.
- WALLIS, J. T.**, General Superintendent of Motive Power, Pennsylvania Railroad Company, Altoona, Pennsylvania.
- WALSH, WM. J.**, Fayette R. Plumb, Inc., Bridesburg, P. O., Philadelphia, Pennsylvania.
- WALTON, HORACE**, Insurance, 416-420 Walnut Street, Philadelphia, Pennsylvania.
- WANAMAKER, JOHN**, Merchant, 1300 Market Street, Philadelphia, Pennsylvania.
- WARD, ALGER L.**, Chemist, 1926 Spencer Street, Philadelphia, Pennsylvania.
- WARDEN, WILLIAM G.**, 1012 Witherspoon Building, Philadelphia, Pennsylvania.
- WARDROP, G. DOUGLAS**, Managing Editor, Aerial Age, Foster Building, Madison Avenue and 40th Street, New York City, New York.
- WARNER, WM. R., JR.**, (Retired), Duffryn Mawr, Chester County, Pennsylvania.
- WARNOCK, JAMES, JR.**, Bookkeeper, 333 Chestnut Street, Philadelphia, Pennsylvania.
- WARRINER, S. D.**, President, Lehigh Coal and Navigation Company, 437 Chestnut Street, Philadelphia, Pennsylvania.
- WARWICK, J. F.**, Electrical Engineer, 61 Crew Street, Atlanta, Georgia.
- WATSON, JAMES**, Steam Specialty Manufacturer, 146 North Seventh Street, Philadelphia, Pennsylvania.
- WEBSTER, ALBERT L.**, Consulting Sanitary Engineer, 112 E. 40th Street, New York City, New York.
- WEBSTER, GEORGE S.**, Civil Engineer 4900 Penn Street, Frankford, Philadelphia, Pennsylvania.
- WEBSTER, WM. R.**, Consulting and Inspecting Engineer, 413 Walnut Street, Philadelphia, Pennsylvania.
- WEDGE, UTLEY**, Engineer, Sulphuric Acid Expert, Ardmore, Pennsylvania.
- WEEKS, EDWIN R.**, Consulting Engineer, 604-6 New Nelson Building, Kansas City, Missouri.
- WEINBERG, SOLOMON**, Chemical Engineer, Sunderland House, 35th Street and Powelton Avenue, Philadelphia, Pennsylvania.
- WEISS, J. M.**, Manager, Research Department, The Barrett Company, 40 Rector Street, New York City, New York.

- MEYER, H. CONRAD**, Vice President, Foote Mineral Company, and for mail, 203 East Willow Grove Avenue, Chestnut Hill, Philadelphia, Pennsylvania.
- MIDDLETON, ALBERT C.**, Director, 149 East Main Street, Moorestown, New Jersey.
- MILES, J. WALTER**, Electrical Engineer, Irwin, Pennsylvania.
- MILLER, ADOLPH W.**, Wholesale Drugs, 400 North 3rd Street, Philadelphia, Pennsylvania.
- MILLER, CASPER W.**, Physician, Wallingford, Pennsylvania.
- MILLER, EARL R.**, 1409 Jefferson Street, Philadelphia, Pennsylvania.
- MILLER, FRANK P.**, Frank P. Miller Paper Company, East Downingtown, Pennsylvania.
- MILLER, FRED J.**, Factory Manager, Stockton, New Jersey.
- MILLER, GUYON**, President, Downingtown Manufacturing Company, Downingtown, Pennsylvania.
- MILLER, SIMON**, Textile Manufacturer, 901 North 16th Street, Philadelphia, Pennsylvania.
- MILLER, W. LASH**, Professor of Physical Chemistry, and for mail, 8 Hawthorne Avenue, Toronto, Canada.
- MILLIKEN, J.**, President, The Industrial Car Manufacturer's Institute, Room 801, 68 William Street, New York City, New York.
- MILLS, GEO. M.**, President, Thomas Mills and Brothers, Incorporated, 1301 North 8th Street, Philadelphia, Pennsylvania.
- MILNE, DAVID**, Manufacturer, School House Lane, Germantown, Philadelphia, Pennsylvania.
- MILNE, FRANCIS F., Jr.**, 1714 Spruce Street, Philadelphia, Pennsylvania.
- MILNER, B. B.**, Engineer of Motive Power, in care of Frazer and Company, 30 Church Street, New York City, New York.
- MINER, HARLAN S.**, Chief Chemist, Welsbach Company, Gloucester, New Jersey.
- MISSIMER, GEORGE, JR.**, Farmer, West Port Royal Avenue, Roxborough, Philadelphia, Pennsylvania.
- MITCHELL, HENRY F.**, Glazed Kid Manufacturer, 36th and Reed Streets, Philadelphia, Pennsylvania.
- MITTEN, T. E.**, Chairman of Executive Committee, Philadelphia Rapid Transit Company, 1520 Spruce Street, Philadelphia, Pennsylvania.
- MIKER, CHARLES A.**, Engineer, Rumford Falls Power Company, Rumford, Maine.
- MODJESKI, RALPH**, Consulting Civil Engineer, 220 South Michigan Blvd., Chicago, Illinois.
- MOORE, ALFRED**, Attorney-at-Law, 618 North American Building, Philadelphia, Pennsylvania.
- MOORE, ALLEN J.**, Assistant Inspector of Ordnance, Navy Office, Bethlehem Steel Company, 511 South 6th Street, Allentown, Pennsylvania.
- MOORE, DAVID PELTON**, Patent Attorney, Warder Building, Washington, D. C.
- MOORE, HORACE E.**, Superintendent, 6429 Jefferson Street, Germantown, Philadelphia, Pennsylvania.
- MOORE, WALTER T.**, Foreign Freight Agent, 308 Bourse Building, Philadelphia, Pennsylvania.
- MOORE, W. E.**, Vice President and General Manager, West Penn Traction Company, Room 705, Union Bank Building, Pittsburgh, Pennsylvania.
- MORAN, ROBERT**, (Retired), Rosario, San Juan County, Washington.
- MORGAN, D. BRUCE**, Consulting Engineer, 805 Gotham National Bank Building, New York City, New York.
- MORGAN, MARSHALL S.**, Fidelity Trust Company, 325 Chestnut Street, Philadelphia, Pennsylvania.
- MORGAN, RANDAL**, First Vice President, United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- MORLEY, EDWARD W.**, Emeritus Professor of Chemistry, Western Reserve University, and for mail, West Hartford, Connecticut.
- MORRIS, A. SAUNDERS**, Mechanical Engineer, Haverford, Pennsylvania.
- MORRIS, EFFINGHAM B.**, Treasurer Committee of Public Safety, State of Pennsylvania, in care of Girard Trust Company, Philadelphia, Pennsylvania.
- MOYER, J. A.**, Director, Massachusetts Board of Education, State House, Boston, Massachusetts.
- MULLER, EDWARD ALBERT**, Vice President and Secretary, The King Machine Tool Company, and for mail, 839 Mitchell Avenue, Avondale, Cincinnati, Ohio.
- MULLER, RALPH H.**, Student of Chemical Engineering, University of Pennsylvania, and for mail, 1209 Rush Street, Philadelphia, Pennsylvania.
- MUNROE, Captain CHARLES W.**, (Retired), 205 Elm Avenue, Swarthmore, Pennsylvania.
- MURDOCK, JOSEPH B.**, Rear Admiral, U. S. N., (Retired), Danbury, New Hampshire.
- MURPHY, WALTER B.**, Manufacturing Manager, The Barrett Company, Chemical Department, Frankford, Philadelphia, Pennsylvania.
- MURRAY, B. L.**, Chemist, Merck and Company, Rahway, New Jersey.

- MURRAY, J. F., Assistant to Chief Engineer, Pennsylvania Railroad Company, 607 Broad Street Station, Philadelphia, Pennsylvania.
- MURRAY, THOMAS E., Consulting Electrical Engineer, 124 East 15th Street, New York City, New York.
- MURRAY, WILLIAM S., Consulting Engineer, 709 Sixth Avenue, New York City, New York.
- NAVARRO, JUSTO LOPEZ, Electrical Engineer, 121 Liguerrero, Ermita, Manila, Philippine Islands.
- NEEDLES, A. C., General Manager, Norfolk and Western Railway Company, Roanoke, Virginia.
- NEILER, SAMUEL G., Consulting Mechanical and Electrical Engineer, 1409 Manhattan Building, Chicago, Illinois.
- NELL, PHILIP, 3619 North Marshall Street, Philadelphia, Pennsylvania.
- NETHERY, JOHN E., (Retired), 3333 North Broad Street, Philadelphia, Pennsylvania.
- NEWBOLD, CLEMENT B., Banker, 511 Chestnut Street, Philadelphia, Pennsylvania.
- NICE, EUGENE E., Manufacturer, 272 South 2nd Street, Philadelphia, Pennsylvania.
- NICHOLS, CARROLL B., 1214 Widener Building, Philadelphia, Pennsylvania.
- NICHOLS, Dr. WILLIAM H., Chairman of Board of Directors, The Allied Chemical and Dye Corporation, 61 Broadway, New York City, New York.
- NORMAN, BRADFORD, Farmer, Newport, Rhode Island.
- NORMAN, REGINALD, Farmer, Newport, Rhode Island.
- NORRIS, GEORGE L., Tool Specialist, 222 West 2nd Street, Wilmington, Delaware.
- NORTH, R. H., North Brothers Manufacturing Company, Lehigh Avenue and American Street, Philadelphia, Pennsylvania.
- NORTHROP, EDWARD FITCH, Research Physicist, Palmer Physical Laboratory, Princeton, New Jersey.
- NOYES, STEPHEN H., Civil Engineer, Room 746, City Hall, Philadelphia, Pennsylvania.
- NUTTING, Dr. P. G., Director of Research, 848 First Street, Ocean City, New Jersey.
- OATLEY, H. B., Chief Engineer, Locomotive Superheater Company, 145 Wilson Avenue, Flushing, New York.
- OBERLY, ALBERT D., Civil Engineer, Scottsdale, Pennsylvania.
- OHMER, WILL I., President, Recording and Computing Machines Company, Dayton, Ohio.
- OLSEN, THORSTEN Y., Vice President and Treasurer, Tinius Olsen Testing Machine Company, 500 North 12th Street, Philadelphia, Pennsylvania.
- OLSEN, TINIUS, Mechanical Engineer, 500 North 12th Street, Philadelphia, Pennsylvania.
- ONNES, HEIKE KAMERLINGH, Physicist, University of Leiden, Leiden, Holland.
- ORROK, GEORGE A., Consulting Engineer, 17 Battery Place, New York City, New York, and for mail, R. F. D. No. 2, Willimantic, Connecticut.
- ORUM, MORRIS L., Manufacturer of Wood Working Machinery, 1320 North 19th Street, Philadelphia, Pennsylvania.
- OSBORNE, L. A., Vice President, Westinghouse Electric and Manufacturing Company, 165 Broadway, New York City, New York.
- OTIS, SPENCER, Manufacturer, Railway Exchange Building, Chicago, Illinois.
- OTT, G. F., President, George F. Ott Company, 325 Hansberry Street, Philadelphia, Pennsylvania.
- OUTERBRIDGE, ALEXANDER E., JR., Metallurgist, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- OWEN, BARTRAM ASHMEAD, Civil Engineer, 411 Pine Street, Philadelphia, Pennsylvania.
- PALMER, T. CHALKLEY, 2nd Vice President, American Dyewood Company, and for mail, Chester, Pennsylvania.
- PALMER, WALTER, Engineer, American Dyewood Company, and for mail, 105 West 23rd Street, Chester, Pennsylvania.
- PARDEE, CALVIN, Coal Operator, 447 Drexel Building, Philadelphia, Pennsylvania.
- PARISH, LE GRAND, President, American Arch Company, 30 Church Street, New York City, New York.
- PARKER, EDWARD W., Statistician and Economist, 437 Chestnut Street, Philadelphia, Pennsylvania.
- PARKER, JOHN C., in care of Lefax, Inc., Sheridan Building, Philadelphia, Pennsylvania.
- PARR, S. W., Professor of Applied Chemistry, 107 Chemistry Building, Urbana, Illinois.
- PARSONS, Sir CHARLES A., 6 Windsor Terrace, Newcastle-on-Tyne, England.
- PATTERSON, C. STUART, Banker, Western Saving Fund Society of Philadelphia, 1004 Walnut Street, Philadelphia, Pennsylvania.
- PATTERSON, FRANCIS D., Physician, Chief of Division of Industrial Hygiene and Engineering, Department of Labor and Industry, Harrisburg, and for mail, 3600 Grays Ferry Road, Philadelphia, Pennsylvania.
- PATTERSON, J. EDWARD, Vice President, Arthur H. Thomas Company, 230 South 7th Street, Philadelphia, Pennsylvania.

- PAUL, H. N.**, Attorney-at-Law, 1815 Land Title Building, Philadelphia, Pennsylvania.
- PAUL, LAWRENCE T.**, Consulting Engineer, 105 Liberty Building, Broad and Chestnut Streets, Philadelphia, Pennsylvania.
- PEACOCK, S.**, Manufacturer of Chemist's Supplies, Wheeling Steel Building, Wheeling, West Virginia.
- PEARSON, JOSHUA A.**, Purchasing Agent, The United Gas Improvement Company, 1401 Arch Street, Philadelphia, Pennsylvania.
- PEASE, F. N.**, Chief Chemist, Pennsylvania Railroad Company, P. O. Box 503, Altoona, Pennsylvania.
- PEASE, FRANCIS G.**, Astronomical Engineer, Mt. Wilson Solar Observatory, Pasadena, California.
- PECK, G. L.**, Vice President, Personnel Department Pennsylvania System, Broad Street Station, Philadelphia, Pennsylvania.
- PEMBERTON, HENRY R.**, Student, 1008 Clinton Street, Philadelphia, Pennsylvania.
- PENNIE, JOHN C.**, Pennie, Davis, Marvin & Edmunds, Counsellors-at-Law, 165 Broadway, New York City, New York.
- PENNOCK, GEO. L.**, Florist, 165 West Essex Avenue, Lansdowne, Pennsylvania.
- PENROSE, CHARLES**, Electrical Engineer, in care of Day and Zimmerman, 611 Chestnut Street, Philadelphia, Pennsylvania.
- PENROSE, R. A. F., JR.**, Geologist, 460 Bullitt Building, Philadelphia, Pennsylvania.
- PEPPER, DAVID**, Engineer, Commonwealth Building, Philadelphia, Pennsylvania.
- PEROT, T. MORRIS, JR.**, Malt Manufacturer, 808 Lafayette Building, Philadelphia, Pennsylvania.
- PERROT, EMILE G.**, Architect and Engineer, Boyertown Building, 1211 Arch Street Philadelphia, Pennsylvania.
- PERRY, ROBERT S.**, President, Franklin H. Kalbfleish Company, 31 Union Square, West, New York City, New York.
- PERSHING, General JOHN J.**, War Department, Washington, D. C.
- PEW, J. HOWARD**, President, Sun Oil Company, and Sun Shipbuilding Company, Finance Building, Philadelphia, Pennsylvania.
- PHELAN, HUNTER C.**, 651 Salem Avenue, Dayton, Ohio.
- PHILIPS, EDWIN S.**, President, Philbrin Corporation, Kennett Square, Pennsylvania.
- PICOLET, LUCIENE**, The Franklin Institute, Philadelphia, Pennsylvania.
- PIERCE, G. A.**, Electrical Engineer, Wm. Cramp & Sons Ship and Engine Building Company, Philadelphia, Pennsylvania.
- PITMAN, Brig. General, JOHN**, (Retired) 167 Berkeley Avenue, Orange, New Jersey.
- PLACK, W. L.**, Architect and Structural Engineer, S. W. Corner 12th and Locust Streets, Philadelphia, Pennsylvania.
- PLATT, H. H.**, Mechanical Engineer, Scarsdale, New York.
- POPE, RALPH W.**, Honorary Secretary, American Institute of Electrical Engineers, 570 Cherry Street, Elizabeth, New Jersey.
- PORTER, J. BENTON**, Electrical Engineer, 1527 Spruce Street, Philadelphia, Pennsylvania.
- PORTER, ROLAND G.**, Gas Engineer, Swarthmore, Pennsylvania.
- POSER, Dr. M.**, 16 Vick Park B, Rochester, New York.
- POSTLETHWAITE, C. E.**, General Sales Manager, Pressed Steel Car Company, 55 Broad Street, New York City, New York.
- POTTS, JOSHUA R. H.**, Attorney-at-Law, 929 Chestnut Street, Philadelphia, Pennsylvania.
- POTTS, WILLIAM M.**, Civil Engineer, Wyebrooke, Chester County, Pennsylvania.
- PRATT, CARL D.**, Chemist, 412 West Broad Street, Tamaqua, Pennsylvania.
- PRENDERGAST, A. P.**, Mechanical Superintendent, Texas and Pacific Railway Company, General Office Building, Dallas, Texas.
- PRICE, MAX CHARLES**, Architect, Punta Gorda, Florida.
- PRICE, MORTON MOORE**, Sales Agent, The Babcock and Wilcox Company, 1010 North American Building, Philadelphia, Pennsylvania.
- PURCELL, JOHN**, Assistant to Vice President, Atchison, Topeka and Sante Fe Railway Company, 80 East Jackson Boulevard, Chicago, Illinois.
- PYLE, WALTER L.**, Physician, 1931 Chestnut Street, Philadelphia, Pennsylvania.
- QUAYLE, R.**, General Superintendent of Motive Power and Car Departments, Chicago and Northwestern Railway Company, Station E., Chicago, Illinois.
- QUIMBY, HENRY H.**, Consulting Structural Engineer, 3920 Girard Avenue, Philadelphia, Pennsylvania.
- QUINN, C. H.**, Chief Electrical Engineer, Norfolk and Western Railway Company, Roanoke, Virginia.
- RADFORD, ROBERT**, Manufacturer, 1103 Morris Building, Philadelphia, Pennsylvania.
- RAE, JOHN**, Shop Engineer, Bement-Miles Works, Niles-Bement-Pond Company, and for mail, 4945 Larchwood Avenue, Philadelphia, Pennsylvania.

- RAMSEY, GEORGE W., Patent Attorney, Woolworth Building, New York City, New York.
- RAPP, I. M., Physicist, R. D. 3, Phoenixville, Pennsylvania.
- RAUTENSTRAUCH, WALTER, Professor of Mechanical Engineering, 43 Exchange Place, New York City, New York.
- RAYMOND, WARD, Mechanical Engineer, 908 Paxinosa Avenue, Easton, Pennsylvania.
- REA, SAMUEL, President, Pennsylvania Railroad Company, Broad Street Station, Philadelphia, Pennsylvania.
- REATH, THEODORE, Attorney-at-law, 1201 Commercial Trust Building, Philadelphia, Pennsylvania.
- REBER, COLONEL SAMUEL, 27 Van Dum Street, New York City, New York.
- REBMANN, G. R., Vice President, Otis Elevator Company, 16th & Sansom Streets, Philadelphia, Pennsylvania.
- REDFIELD, ROBERTS, Wayne, Pennsylvania.
- REED, G. BERKELEY, Inventor, 80 St. James Place, Brooklyn, New York.
- REED, HOMER, JR., Banker, Engineering Department, Chandler and Company, Bankers, 700 Franklin Bank Building, Philadelphia, Pennsylvania.
- REESE, CHARLES L., Chemical Engineer, E. I. du Pont de Nemours & Company, Wilmington, Delaware.
- REICHARDT, HENRY, (Retired), 3581 Queen Lane, East Falls, Philadelphia, Pennsylvania.
- RENO, JESSE W., Consulting Engineer, 684 St. Nicholas Avenue, New York City, New York.
- REOCH, ALEXANDER ERNEST, Electrical Engineer, The Radio Corporation of America, 233 Broadway, New York City, New York.
- RESINES, JAVIER, Industrial Chemist, Racquet Club, Philadelphia, Pennsylvania.
- RHOADS, J. J., Superintendent, Pennsylvania Railroad Company, 407 West 2nd Street, Oil City, Pennsylvania.
- RICE, E. W., JR., Electrical Engineer, President, General Electric Company, Schenectady, New York.
- RICE, CHARLES D., Manager of Factory, Underwood Typewriter Company, 581 Capitol Avenue, Hartford, Connecticut.
- RICHARDS, EDGAR, Retired Chemist, 60 Ayrault Street, Newport, Rhode Island.
- RICHARDS, J. W., Professor of Metallurgy, Lehigh University, Bethlehem, Pennsylvania.
- RICHARDS, THEODORE WM., Director, Wolcott Gibbs Memorial Laboratory, Harvard University, Cambridge, Massachusetts.
- RICHARDSON, CHARLES E., Engineer, Chas. E. Richardson and Company, Engineers, 18 East 60th Street, New York City, New York.
- RICHMOND, WILLIAM, H., Retired Coal Operator, Richmond Villa, 1718 Capouse Avenue, Scranton, Pennsylvania.
- RICKETTS, L. D., Mining Engineer, Warren, Arizona.
- RIDGWAY, ELLIS B., Manufacturer, 367 West Main Street, Coatesville, Pennsylvania.
- RIDGWAY, ROBERT, Engineer, in care of Public Service Company, 49 Lafayette Street, New York City, New York.
- RIDWAY, WILLIAM H., Civil Engineer and Manufacturer, The Craig Ridway and Son Company, Coatesville, Pennsylvania.
- RIEHLE, FRED A., Testing Machine Manufacturer, 1424 North 9th Street, Philadelphia, Pennsylvania.
- RIGLING, ALFRED, Librarian, The Franklin Institute, and for mail, 4835 Haverford Avenue, Philadelphia, Pennsylvania.
- RILEY, LEWIS A., Civil and Mining Engineer, Lafayette Building, 437 Chestnut Street, Philadelphia, Pennsylvania.
- RILLIET, CHARLES E., Teacher, 4100-06 South Vermont Avenue, Los Angeles, California.
- RINGWALT, ROLAND, Clergyman, 3016 Carman Street, Camden, New Jersey.
- RITTENHOUSE, EDWARD, Chemical Engineer, Aldam, Pennsylvania.
- RITTER, LOUIS E., Consulting Civil Engineer, 1707 Marquette Building, Chicago, Illinois.
- RITTMAN, Dr. W. F., Chemical Engineer, Salem, Ohio.
- ROBB, RUSSELL, Member of Firm, Stone and Webster Engineering Corporation, 147 Milk Street, Boston, Massachusetts.
- ROBERTS, WILMER, Palmyra, New Jersey.
- ROBINSON, ANTHONY W., Insurance, 409 Chestnut Street, Philadelphia, Pennsylvania.
- ROBINSON, DWIGHT P., Consulting Engineer, 49 East 52nd Street, New York City, New York.
- ROBINSON, EDMUND G., Chemist, 909 Nottingham Road, Wilmington, Delaware.
- RODMAN, HUGH, Engineer and Manufacturer, in care of Rodman Chemical Company, Verona, Pennsylvania.

- ROESSLER, FRANK**, Manufacturing Chemist, 89 High Street, Perth Amboy, New Jersey.
- ROGERS, ALLEN**, Teacher, Pratt Institute, Brooklyn, New York.
- ROGERS, MRS. AUGENE P.**, 4007 Powelton Avenue, Philadelphia, Pennsylvania.
- ROGERS, FRANK H.**, Mechanical Engineer, William Cramp and Sons, Ship and Engine Building Company, Philadelphia, Pennsylvania.
- ROGERS, JAMES S.**, Attorney-at-Law, 701 Commonwealth Trust Building, Philadelphia, Pennsylvania.
- ROLLE, SYLVAN D.**, Draftsman, The Bell Telephone Company of Pennsylvania, and for mail, 2143 North 19th Street, Philadelphia, Pennsylvania.
- ROLLER, FRANK W.**, Electrical and Mechanical Engineer, 233 Broadway, New York City, New York.
- RONDINELLA, L. F.**, Professor of Drawing and Designing, West Philadelphia High School for Boys, 48th and Walnut Streets, Philadelphia, Pennsylvania.
- ROSENBAUM, MORRIS**, Foreign Exchange, 605 South 3rd Street, Philadelphia, Pennsylvania.
- ROSENBAUM, W. A.**, Patent Attorney, 41 Park Row, New York City, New York.
- ROSENGARTEN, FRANK H.**, Chemist, 1905 Walnut Street, Philadelphia, Pennsylvania.
- ROSENGARTEN, FREDERIC**, Manufacturing Chemist, P. O. Box 1625, Philadelphia, Pennsylvania.
- ROSENGARTEN, GEORGE D.**, Manufacturing Chemist, P. O. Box 1625, Philadelphia, Pennsylvania.
- ROSIN, JOSEPH**, Chemist, Powers-Weightman-Rosengarten Company, 9th and Parrish Streets, Philadelphia, Pennsylvania.
- ROSS, T. EDWARD**, Certified Public Accountant, 1209 Morris Building, Philadelphia, Pennsylvania.
- ROWLAND, CHARLES B.**, Vice President, Continental Iron Works, West and Calyer Streets, Brooklyn, New York.
- RUGG, W. S.**, The University Club, 4439 Grant Boulevard, Pittsburgh, Pennsylvania.
- RUMBOUGH, J. B.**, Consulting Mechanical Engineer, P. O. Box 224, Reno, Nevada.
- RUMELY, W. N.**, 3020 Sheridan Road, Chicago, Illinois.
- RUMFORD, WM. C.**, Address unknown.
- RUSBY, J. M.**, Engineer of Tests, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- RUSSELL, CHARLES J.**, Manager, Sales Department, The Philadelphia Electric Company, 10th and Chestnut Streets, Philadelphia, Pennsylvania.
- SADTLER, Dr. SAMUEL P.**, Consulting Chemist, 210 South 13th Street, Philadelphia, Pennsylvania.
- SADTLER, SAMUEL S.**, Consulting Chemist, 210 South 13th Street, Philadelphia, Pennsylvania.
- SAEGMULLER, G. N.**, Vice President, in care of Bausch and Lomb Optical Company Rochester, New York.
- SALMON, FREDERICK W.**, Civil and Mechanical Engineer, Richmond, Virginia.
- SALOM, PEDRO G.**, Electro-Chemical Engineer, Commonwealth Trust Building, Philadelphia, Pennsylvania.
- SAMUEL, J. BUNFORD**, Retired Iron Merchant, 1609 Spruce Street, Philadelphia, Pennsylvania.
- SANBORN, EDWARD H.**, Coal Mining, 1100 Commercial Trust Building, Philadelphia, Pennsylvania.
- SANDERSON, R. P. C.**, in care of The Baldwin Locomotive Works, 34 Victoria Street, London, England.
- SANDT, A. R.**, Consulting Engineer, 716-18 Metropolitan Life Building, Minneapolis, Minnesota.
- SANFORD, RUFUS H.**, Librarian, The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- SARGENT, C. E.**, Chief Engineer, Lyons Atlas Company, 2020 North Delaware Street, Indianapolis, Indiana.
- SARGENT, HENRY B.**, Hardware Manufacturer, 247 Church Street, New Haven, Connecticut.
- SARTAIN, PAUL J.**, Physician, 2006 Walnut Street, Philadelphia, Pennsylvania.
- SARTAIN, WILLIAM**, Artist, 140 West 57th Street, New York City, New York.
- SATTERTHWAITE, GEORGE**, Manufacturer of Steel, in care of Tacony Steel Company, Tacony, Philadelphia, Pennsylvania.
- SAUER, FRANK H.**, Draftsman, 1307 Atlantic Avenue, Camden, New Jersey.
- SAUNDERS, WALTER M.**, Analytical and Consulting Chemist, 20 Dewey Street, Olneyville, Providence, Rhode Island.
- SAWTELLE, WILLIAM OTIS**, Professor of Physics, Haverford College, Haverford, Pennsylvania.
- SCATTERGOOD, HENRY W.**, Manufacturer, 503 Land Title Building, Philadelphia, Pennsylvania.
- SCHAEFER, GEORGE F.**, 5th and Cherry Streets, Philadelphia, Pennsylvania.

- SCHEHL, OSCAR L., Mechanical Engineer, 1631 Girard Avenue, Philadelphia, Pennsylvania.
- SCHLAFGE, WILLIAM S., General Mechanical Superintendent, Erie Railroad Company, 50 Church Street, New York City, New York.
- SCHLICKE, C. P., Treasurer and Secretary, 31 Plaza Street, Brooklyn, New York.
- SCHROM, OSCAR G., Mechanical Engineer, 6017 Nassau Street, Philadelphia, Pennsylvania.
- SCOTT, WM. M., Draftsman, Box 76, Radnor, Pennsylvania.
- SEELY, LESLIE B., Teacher, 5918 Pulaski Avenue, Germantown, Philadelphia, Pennsylvania.
- SEIBERLING, F. A., Manufacturer, 1144 East Market Street, Akron, Ohio.
- SELGA, M., Manila Observatory, Manila, Phillippine Islands.
- SELLERS, ALEXANDER, Manufacturer, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- SELLERS, COLEMAN, JR., Mechanical Engineer, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- SELLERS, HORACE W., Architect, Ardmore, Pennsylvania.
- SELLERS, HOWARD, Millbourne House, Millbourne, Pennsylvania.
- SELLERS, RICHARD, Bellevue, Delaware.
- SELLERS, RICHARD C., Civil Engineer, Swarthmore, Pennsylvania.
- SELLERS, MRS. WILLIAM, Bellevue, Delaware.
- SELLERS, WILLIAM F., Manufacturer of Water Tube Boilers, Edge Moor, Delaware.
- SEVERY, MELVIN L., Inventor and Author, 431 South Berendo Street, Los Angeles, California.
- SHACKELFORD, BENJAMIN E., Physicist, Westinghouse Lamp Company, Bloomfield, New Jersey.
- SHAND, A. C., Civil Engineer, Narberth, Pennsylvania.
- SHARER, CARL W., Superintendent of Equipment, The Keystone Telephone Company, and for mail, 446 East Walnut Lane, Germantown, Philadelphia, Pennsylvania.
- SHARP, Dr. CLAYTON H., Technical Director, Electrical Testing Laboratories, 80th Street and East End Avenue, New York City, New York.
- SHARP, W. H., Paper Manufacturer, The Wellington, 19th and Walnut Streets, Philadelphia, Pennsylvania.
- SHARPLES, STEPHEN P., Chemical Engineer, 22 Concord Avenue, Cambridge, Massachusetts.
- SHATTUCK, A. F., Chief Chemist, Solvay Process Company, and for mail, 615 Canon Drive, Beverly Hills, California.
- SHATTUCK, JOHN D., Gas Engineer, Chester, Pennsylvania.
- SHEARD, Dr. CHARLES, Editor, The American Journal of Physiological Optics, Southbridge, Massachusetts.
- SHERWOOD, L. T., Chemist, P. O. Box 196, Carney's Point, New Jersey.
- SHIMER, PORTER W., Chemist and Metallurgist, Easton, Pennsylvania.
- SHMIDHEISER, W. A., Mechanical Engineer, The Bell Telephone Company of Pennsylvania and for mail, 6017 Pine Street, Philadelphia, Pennsylvania.
- SHOEMAKER, SAMUEL, Builder and Real Estate, 1132 Land Title Building, Philadelphia, Pennsylvania.
- SHOEMAKER, THOMAS H., (Retired), 120 West Tulpehocken Street, Germantown, Philadelphia, Pennsylvania.
- SILCOX, LEWIS K., Mechanical and Electrical Engineer, Herrick Road, Box 570, Riverside, Illinois.
- SILLIMAN, FRANK, JR., Engineer and Manager, 5987 Woodbine Avenue, Overbrook, Philadelphia, Pennsylvania.
- SIMSOHN, JULIAN STERN, Chemist, S. E. corner Broad Street and Girard Avenue, Philadelphia, Pennsylvania.
- SINKLER, JOHN P. B., Architect, 412 Otis Building, 112 South 16th Street, Philadelphia, Pennsylvania.
- SKINNER, C. E., Engineer, Research Division, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania.
- SKINNER, H. J., Chemical Engineer, Vice President, Arthur D. Little, Incorporated, 71 West Chestnut Street, Wakefield, Massachusetts.
- SKINNER, ORVILLE CAMPBELL, Metallurgical Engineer, Superintendent, Standard Steel Works, Burnham, Pennsylvania.
- SLATER, HOWARD C., Mechanical Engineer, P. O. Box 332, Ridley Park, Pennsylvania.
- SMALLING, ELMER, JR., Student, 2939 North Camac Street, Philadelphia, Pennsylvania.
- SMITH, A. D. W., Mining Engineer, Coal Exchange Building, Wilkes-Barre, Pennsylvania.
- SMITH, ALBERT W., Professor of Industrial Chemistry, Case School of Applied Science, and for mail, 11333 Bellflower Road, Cleveland, Ohio.
- SMITH, A. T., in care of The Permutit Company, 440 Fourth Avenue, New York City, New York.

- SMITH, AUGUSTUS**, Civil Engineer, Elizabeth, R. F. D. No. 2, New Jersey.
- SMITH, EDWARD W.**, Chemical Engineer, 735 East Penn Street, Germantown, Philadelphia, Pennsylvania.
- SMITH, FRANK W.**, Vice President and General Manager, The United Electric Light and Power Company, 130 East 15th Street, New York City, New York.
- SMITH, HERBERT S. S.**, Professor of Civil Engineering, Princeton University, and for mail, P. O. Box 161, Princeton, New Jersey.
- SMITH, IRVING B.**, Chief of Research Department, Leeds and Northrup Company, and for mail, Ambler, Pennsylvania.
- SMITH, J. WALDO**, Chief Engineer, Board of Water Supply, City of New York, Municipal Building, New York City, New York.
- SMITH, LESLIE DENIS**, Color Investigation Laboratory, Bureau of Chemistry, U. S. Dept. of Agriculture, Washington, D. C.
- SMITH, N. W.**, Superintendent, Middle Division, Pennsylvania Railroad Company, Altoona, Pennsylvania.
- SMITH, OBERLIN**, Mechanical Engineer and Manufacturer, in care of Ferracute Machine Company, Bridgeton, New Jersey.
- SMITH, P. F., JR.**, Manager, Altoona Works, Pennsylvania System, Altoona, Pennsylvania.
- SMITH, S. D.**, Machinist, 1616 North Redfield Street, Philadelphia, Pennsylvania.
- SMITH, WALTER B.**, Builder, 6490 Woodbine Avenue, Overbrook, Philadelphia, Pennsylvania.
- SMITH, W. HINCKLE**, Banker, Bryn Mawr, Pennsylvania.
- SMITH, W. LEHIGH**, Chemist, The Viscose Company, Box 171, Marcus Hook, Pennsylvania.
- SNELLENBURG, SAMUEL**, Merchant, Market in care of Twelfth Streets, Philadelphia, Pennsylvania.
- SNELLING, WALTER O.**, Research Chemist, 208 North 5th Street, Allentown, Pennsylvania.
- SNOOK, H. CLYDE**, Electrical Engineer, c/o Western Electric Company, 463 West Street, New York City, New York.
- SNYDER, CLINTON F.**, Chemist, Minersville, Pennsylvania.
- SNYDER, Professor MONROE B.**, Teacher and Astronomer, 111 Grand View Road, Ardmore, Pennsylvania.
- SOULAS, CHARLES W.**, Hotel Proprietor, 1108 Sansom Street, Philadelphia, Pennsylvania.
- SOUTHALL, JAMES P. C.**, Associate Professor of Physics, Columbia University, New York City, New York.
- SPACKMAN, H. S.**, President, Henry S. Spackman Engineering Company, 2024 Arch Street, Philadelphia, Pennsylvania.
- SPARKS, THOMAS W.**, Trustee of Estates, 4100 Walnut Street, Philadelphia, Pennsylvania.
- SPARRE, FIN**, Chemist, E. I. du Pont de Nemours and Company, Room 450, du Pont Building, Wilmington, Delaware.
- SPENCER, H. B.**, President, Fruit Growers' Express Company, Munsey Building, Washington, D. C.
- SPENCER, PAUL**, Electrical Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- SPENCER, THOMAS**, Engineer, 3523 Balsam Avenue, Indianapolis, Indiana.
- SPERR, F. W., JR.**, Chief Chemist, H. Koppers Company Laboratory, Mellon Institute, Pittsburgh, Pennsylvania.
- SPERRY, ELMER A.**, Engineer, The Sperry Gyroscope Company, Sperry Building, Manhattan Bridge Plaza, Brooklyn, New York.
- SPICER, H. N.**, Metallurgical Engineer, The Architects Building, 101 Park Avenue, New York City, New York.
- SPITZ, SAMUEL**, Inventor, 372 Bellevue Avenue, Oakland, California.
- SPITZGLASS, J. M.**, Mechanical Engineer, 2240 Diversey Boulevard, Chicago, Illinois.
- SPRAGUE, FRANK J.**, Consulting Engineer, President, Sprague Safety Control & Signal Corporation, 421 Canal Street, New York City, New York.
- SPRONG, S. D.**, Electrical Engineer, Brooklyn Edison Company, 360 Pearl Street, Brooklyn, New York.
- SPRUANCE, W. C.**, Vice President, in Charge of Production Department, E. I. du Pont de Nemours and Company, and for mail, 2507 West 17th Street, Wilmington, Delaware.
- SQUIER, GEORGE OWEN**, Major General, Chief Signal Officer, U. S. Army, K. C. M. G., D. S. C., War Department, Washington, D. C.
- STANFORD, H. R.**, Civil Engineer, Naval Operating Base, Hampton Roads, Norfolk, Virginia.
- STANLEY, FRANK A.**, Editor, East Auburn, California.
- STEEL, JOSEPH M.**, Building Constructor, 1600 Arch Street, Philadelphia, Pennsylvania.
- STEIN, A.**, Manufacturer, 97 Gold Street, New York City, New York.
- STEINMETZ, CHARLES P.**, Chief Consulting Engineer, General Electric Company, and Professor of Electro-Physics, Union College, and for mail, Wendell Avenue, Schenectady, New York.

- STEINMETZ, JOSEPH ALLISON**, Designer, Janney, Steinmetz and Company, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- STEINMETZ, SPENCER J.**, 31 Evans Road, Brookline, Massachusetts.
- STUBER, HENRY J.**, Chemist, 509 South 10th Street, Philadelphia, Pennsylvania.
- STEVENS, F. S.**, Engineer Maintenance of Way, Philadelphia and Reading Railway Company and for mail, 540 North 5th Street, Reading, Pennsylvania.
- STEVENS, JOHN S.**, 9th Street and Montgomery Avenue, Philadelphia, Pennsylvania.
- STEVENSON, D. A. R., Jr.**, Electrical Engineer, General Electric Company, 6 Union Street, Schenectady, New York.
- STEVENSON, S. PRICE**, Manufacturer of Coal Storage Doors, 1500 West 4th Street, Chester Pennsylvania.
- STEWART, FRANK H.**, Dealer in Electrical Supplies, Old Mint Building, Philadelphia, Pennsylvania.
- STEWART, FRANK H.**, Textile Manufacturer, in care of Krout and Fite Manufacturing Company, 1950 East Allegheny Avenue, Philadelphia, Pennsylvania.
- STEWART, RALPH C.**, Attorney-at-Law, 803 West End Trust Building, Philadelphia, Pennsylvania.
- STEWART, THOMAS S.**, Physician, 18th and Spruce Streets, Philadelphia, Pennsylvania.
- STILLWELL, L. B.**, Consulting Engineer, 143 Liberty Street, New York City, New York.
- STINE, WILBUR M.**, Author, 334 West Main Street, Mechanicsburg, Pennsylvania.
- STITZER, A. B.**, Chief Engineer, Republic Engineers, Incorporated, 60 Broadway, New York City, New York.
- STOE^{PT} TZ, HOWARD**, Chemist, Electric Storage Battery Company, and for mail, 4741 Rosehill Street, Philadelphia, Pennsylvania.
- STOKES, FRANCIS J.**, Machinery Manufacturer, 17th and Cambria Streets, Philadelphia, Pennsylvania.
- STONE, CHARLES A.**, Engineer, Member of Firm of Stone and Webster Engineering Corporation, 147 Milk Street, Boston, Massachusetts.
- STONE, C. W.**, Electrical Engineer, General Electric Company, Schenectady, New York.
- STONE, JOHN**, Consulting Electrical Engineer, 4811 Panorama Street, San Diego, California.
- STOTESBURY, E. T.**, Banker, Chestnut and Fifth Streets, Philadelphia, Pennsylvania.
- STOUGHTON, A. B.**, Attorney-at-Law, 1506 Land Title Building, Philadelphia, Pennsylvania.
- STOUT, ORIN C.**, Hydraulic and Sanitary Engineer, Chillicothe, Barr County, Ohio.
- STRADLING, Dr. G. F.**, Teacher, Principal Northeast High School, and for mail, 5120 Newhall Street, Germantown, Philadelphia, Pennsylvania.
- STRONG, WILLIAM WALKER**, Consulting Physicist, 500 South York Street, Mechanicsburg, Cumberland County, Pennsylvania.
- STROUD, EDWARD A.**, Florist, 508 South 41st Street, Philadelphia, Pennsylvania.
- STUTZ, ERNEST**, Representative for Foreign Patents, 1705 Hope Street, South Pasadena, California.
- STYRI, Dr. HAALSON**, Chief Chemist, S. H. F. Research Laboratory, Front Street & Frie Avenue, Philadelphia, Pennsylvania.
- SUCZEK, ROBERT**, Mechanical Engineer, C. H. Wheeler Manufacturing Company, 18th Street and Lehigh Avenue, Philadelphia, Pennsylvania.
- SULZNER, CHARLES F.**, (Retired), 630 14th Street, Miami, Florida.
- SUPPLEE, WM. H.**, Factory Manager, 211 South 12th Street, Philadelphia, Pennsylvania.
- SUTTON, FRANK W.**, Industrial Engineer, Charles E. Bedaux Company, 4500 Euclid Avenue, Cleveland, Ohio.
- SWEET, H. N.**, Banker, 63 Mt. Vernon Street, Boston, Massachusetts.
- SWENSON, MAGNUS**, President and Treasurer, Southern Wisconsin Power Company, Madison, Wisconsin.
- SYKES, JOHN P.**, The Baldwin Locomotive Works, Broad and Spring Garden Streets, Philadelphia, Pennsylvania.
- SYMONS, WILSON E.**, Consulting Engineer, Galena-Signal Cil Company, 41 East 42nd Street, New York City, New York.
- SYNNESTVEDT, ARTHUR**, Student, Bryn Athyn, Pennsylvania.
- TABER, GEORGE H.**, Vice President, Gulf Refining Company, P. O. Box 1214, Pittsburgh, Pennsylvania.
- TAGGART, WALTER T.**, Professor of Chemistry, University of Pennsylvania, Philadelphia, Pennsylvania.
- TAIT, EDWARD H.**, Superintendent, 401 Brighter Apartments, Second & Penn Streets, Reading, Pennsylvania.
- TAIT, F. M.**, 80 Broadway, New York City, New York.
- TAKAMINE, JOKICHI**, Research Chemist, Equitable Building, New York City, New York.
- TALBOT, H. P.**, Professor of Inorganic Chemistry, Massachusetts Institute of Technology, Boston, Massachusetts.

- TATE, ALFRED O.**, President, Tate Electrolytic Textile Processes, Incorporated, Cranston, Rhode Island.
- TATNALL, Dr. ROBERT R.**, Research Engineer, J. E. Rhoads and Sons, Wilmington, Delaware.
- TAWS, LOUIS**, (Retired), 6654 Lincoln Drive, Germantown, Philadelphia, Pennsylvania.
- TAYLOR, DAVID WATSON**, Rear Admiral, Chief, Bureau of Construction and Repair, Navy Department, Washington, D. C.
- TAYLOR, EDWARD B.**, Vice President, Pennsylvania Lines West of Pittsburgh, 901 Pennsylvania Station, Pittsburgh, Pennsylvania.
- TAYLOR, HOLLINSHEAD N.**, Tinplate Manufacturer, 300 Chestnut Street, Philadelphia, Pennsylvania.
- TAYLOR, LOWNDES**, Route No. 1, P. O. Box 3, West Chester, Pennsylvania.
- TEEPLE, JOHN E.**, Consulting Chemist and Chemical Engineer, 50 East 41st Street, New York City, New York.
- TEMPLE, EDWARD B.**, Swarthmore, Pennsylvania.
- THAMM, CHARLES G. A.**, Clerk, 1526 Glenwood Avenue, Philadelphia, Pennsylvania.
- THOMAS, ARTHUR H.**, Laboratory Appliances, West Washington Square, Philadelphia, Pennsylvania.
- THOMAS, C. C.**, Professor of Mechanical Engineering, Dwight P. Robinson and Company, Electric Equipment Building, 1240 South Hope Street, Los Angeles, California.
- THOMPSON, ARTHUR W.**, President, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.
- THOMPSON, CHARLES T.**, 426 Walnut Street, Philadelphia, Pennsylvania.
- THOMPSON, HUGH L.**, Consulting Engineer, Waterbury, Connecticut.
- THOMPSON, PAUL**, N. W. cor. Broad and Arch Streets, Philadelphia, Pennsylvania.
- THOMPSON, ELIHU**, Electrical Engineer, 22 Monument Avenue, Swampscott, Massachusetts.
- THORNE, WILLIAM H.**, Mechanical Engineer, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- TIDDY, WILLIAM**, Chief Chemist, Rainey-Wood Coke Company, Swedeland, Pennsylvania.
- TIEMANN, HUGH P.**, Metallurgical Engineer, Carnegie Steel Company, Pittsburgh, Pennsylvania.
- TIERNEY, L. E.**, Coal Operator, Powhatan, West Virginia.
- TIGERSTEDT, A. F.**, General Director, Board of Trade, Helsingfors, Finland.
- TILGHMAN, B. C.**, Manufacturer, Highfield, Dunham Road, Altrincham, Cheshire, England.
- TITZEL, R. JOHN**, Gas Engineer, Hamilton Apartments, Norristown, Pennsylvania.
- TOCH, MAXIMILIAN**, Paint Manufacturer, Director, Research Laboratory, Toch Brothers, 320 Fifth Avenue, New York City, New York.
- TOLMAN, L. M.**, Chemist, 7217 Yale Avenue, Englewood Station, Chicago, Illinois.
- TORCHIO, PHILIP**, Chief Electrical Engineer, The New York Edison Company, Irving Place and 15th Street, New York City, New York.
- TOULMIN, H. A., JR.**, Patent Attorney, 901 Schwind Building, Dayton, Ohio.
- TOWNE, HENRY R.**, Mechanical Engineer, 420 Park Avenue, New York City, New York.
- TOWNEND, R. V.**, Research Chemist, Victor Talking Machine Company, Camden, New Jersey.
- TOWNSEND, JOHN SEALY**, Professor of Physics, New College, Oxford, England.
- TOWNSEND, J. W.**, 825 Montgomery Avenue, Bryn Mawr, Pennsylvania.
- TRAUTWINE, JOHN C., JR.**, Civil Engineer, 257 South 4th Street, Philadelphia, Pennsylvania.
- TRAUTWINE, JOHN C., 3rd.**, Civil Engineer, Box 6509, Upper Darby Branch, Philadelphia, Pennsylvania.
- TREKLER, HARRY C.**, Colonel, President, Lehigh Portland Cement Company, Allentown, Pennsylvania.
- TRUEMAN, WILLIAM H.**, Dentist, 47 High Street, Germantown, Philadelphia, Pennsylvania.
- TSCHUDY, EARL H.**, Teacher in High School, 613 Canal Street, Lebanon, Pennsylvania.
- TURNER, WILLIAM JAY**, Attorney-at-Law, Lycoming, School House Lane, Germantown, Philadelphia, Pennsylvania.
- TUTWILER, C. C.**, Consulting Gas Chemist, West Conshohocken, Pennsylvania.
- TWINING, WM. STANTON**, Civil Engineer, 119 Harvey Street, Germantown, Philadelphia, Pennsylvania.
- TYSON, H. P.**, Collegeville, Pennsylvania.
- UEHLING, E. A.**, Mechanical Engineer, 3226 McKinley Building, Milwaukee, Wisconsin.
- ULMER, CARL D.**, Chemist, Minnesota By-Product Coke Company, 1000 Hamline Avenue, St. Paul, Minnesota.
- UNDERWOOD, FREDERICK D.**, President, Erie Railroad Company, 50 Church Street, New York City, New York.
- UNWIN, WILLIAM CAWTHORNE**, Civil Engineer, Palace Gate Mansions, Kensington, London, England.

- VAIL, JAMES G.**, Chief Chemist, Philadelphia Quartz Company, 121 South 3rd Street, Philadelphia, Pennsylvania.
- VALASEK, J.**, Physicist, 1117 7th Street, S. E., Minneapolis, Minnesota.
- VAN DER LINGEN, J. STEPHEN**, Physical Laboratory, Johns Hopkins University, Baltimore, Maryland.
- VAN DEVENTER, CHRISTOPHER**, Consulting Engineer, 438 First National Bank Building, Chicago, Illinois.
- VAN DEVENTER, H. R.**, Engineer and Patent Attorney, Bureau Patent Development, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania.
- VAN DYKE, J. W.**, President, The Atlantic Refining Company, The Wellington, Philadelphia, Pennsylvania.
- VAN TRUMP, S. N.**, Civil Engineer, Water Department, Wilmington, Delaware.
- VAUCLAIN, S. M.**, President, The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- VAUGHAN, H. H.**, Engineer, 20 MacGregor Street, Montreal, Quebec, Canada.
- VAUGHEN, F. G.**, Sales Manager, Meter Department, General Electric Company, Schenectady, New York.
- VAUX, GEORGE, JR.**, Attorney-at-Law, Gulf Road, Bryn Mawr, Pennsylvania.
- VEEDER, CURTIS H.**, Manufacturer, Veeder Manufacturing Company, Hartford, Connecticut.
- VIAL, ETHAN**, Editor, Barbourville, Kentucky.
- VOGLESON, JOHN A.**, Civil Engineer, 8009 Crefeldt Street, Philadelphia, Pennsylvania.
- VON KLENSMID, R. B.**, President, University of Arizona, Tucson, Arizona.
- VREELAND, FREDERICK R.**, Research Engineer, 90 West Street, New York City, New York.
- WADDELL, J. A. L.**, Consulting Engineer, 35 Nassau Street, New York City, New York.
- WADLEIGH, F. R.**, Assistant to President, Tuttle Corporation, 15 Broad Street, New York City, New York.
- WADSWORTH, F. L. O.**, Consulting and Advisory Engineer, P. O. Box 1, East Liberty Station Pittsburgh, Pennsylvania.
- WAGNER, FRED H.**, Chief Engineer, The Bartlett Hayward Company, and for mail, Lombardy Apartments, 39th Street and Stony Run Lane, Baltimore, Maryland.
- WAGNER, HERBERT A.**, President, Consolidated Gas Electric Light and Power Company, Lexington and Liberty Streets, Baltimore, Maryland.
- WAGNER, SAMUEL T.**, Chief Engineer, Philadelphia and Reading Railway Company, and for mail, School House Lane, Germantown, Philadelphia, Pennsylvania.
- WALDRON, WILLIAM H.**, Manufacturer of Machinery, John Waldron Company, New Brunswick, New Jersey.
- WALKER, J. W.**, Manufacturer, Address unknown.
- WALLER, ALFRED E.**, Electrical Engineer, Lawrence Park, Bronxville, New York.
- WALLERSTEIN, LEO**, Chemist, 171 Madison Avenue, New York City, New York.
- WALLIS, J. T.**, General Superintendent of Motive Power, Pennsylvania Railroad Company, Altoona, Pennsylvania.
- WALSH, WM. J.**, Fayette R. Plumb, Inc., Bridesburg, P. O., Philadelphia, Pennsylvania.
- WALTON, HORACE**, Insurance, 416-420 Walnut Street, Philadelphia, Pennsylvania.
- WANAMAKER, JOHN**, Merchant, 1300 Market Street, Philadelphia, Pennsylvania.
- WARD, ALGER L.**, Chemist, 1926 Spencer Street, Philadelphia, Pennsylvania.
- WARDEN, WILLIAM G.**, 1912 Witherspoon Building, Philadelphia, Pennsylvania.
- WARDROP, G. DOUGLAS**, Managing Editor, Aerial Age, Foster Building, Madison Avenue and 40th Street, New York City, New York.
- WARNER, WM. R., JR.**, (Retired), Duffryn Mawr, Chester County, Pennsylvania.
- WARNOCK, JAMES, JR.**, Bookkeeper, 333 Chestnut Street, Philadelphia, Pennsylvania.
- WARRINER, S. D.**, President, Lehigh Coal and Navigation Company, 437 Chestnut Street, Philadelphia, Pennsylvania.
- WARWICK, J. F.**, Electrical Engineer, 61 Crew Street, Atlanta, Georgia.
- WATSON, JAMES**, Steam Specialty Manufacturer, 146 North Seventh Street, Philadelphia, Pennsylvania.
- WEBSTER, ALBERT L.**, Consulting Sanitary Engineer, 112 E. 40th Street, New York City, New York.
- WEBSTER, GEORGE S.**, Civil Engineer 4900 Penn Street, Frankford, Philadelphia, Pennsylvania.
- WEBSTER, WM. R.**, Consulting and Inspecting Engineer, 413 Walnut Street, Philadelphia, Pennsylvania.
- WEDGE, UTLEY**, Engineer, Sulphuric Acid Expert, Ardmore, Pennsylvania.
- WEEKS, EDWIN R.**, Consulting Engineer, 604-6 New Nelson Building, Kansas City, Missouri.
- WEINBERG, SOLOMON**, Chemical Engineer, Sunderland House, 35th Street and Powelton Avenue, Philadelphia, Pennsylvania.
- WEISS, J. M.**, Manager, Research Department, The Barrett Company, 40 Rector Street, New York City, New York.

- WELLS, G. A.**, 352 William Street, East Orange, New Jersey.
- WELLS, W. F.**, Vice President, Edison Electric Illuminating Company, 360 Pearl Street, Brooklyn, New York.
- WELSH, FRANCIS RALSTON**, Investments, Devon, Pennsylvania.
- WELTZ, EARL H.**, Chemist, E. I. du Pont de Nemours & Company, 122 Broadway, Carney's Point, New Jersey.
- WERNER, CHARLES H.**, Attorney-at-Law, Werner and McGivney, 61 Broadway, New York City, New York.
- WESTON, EDWARD**, President, Weston Electrical Instrument Company, Waverly Park Newark, New Jersey.
- WESTON, F. W.**, Manufacturer, Wynnewood, Pennsylvania.
- WETHERILL, ROBERT**, Engine and Machine Work Manufacturer, Chester, Pennsylvania.
- WETHERILL, S. P.**, Manufacturer, Room 600 Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- WETHERILL, W. CHATTIN**, Department of Mechanical Engineering, University of Pennsylvania, Philadelphia, Pennsylvania.
- WEYL, CHARLES N.**, Student, 6506 Lincoln Drive, Germantown, Philadelphia, Pennsylvania.
- WHARTON, HENRY**, Chestnut Hill, Philadelphia, Pennsylvania.
- WHITAKER, JAMES L.**, Cotton Manufacturer, Cedar Grove, Olney, Philadelphia, Pennsylvania.
- WHITE, EDWARD E.**, Civil Engineer, Glen White, West Virginia.
- WHITE, J. ATWOOD**, Paper Machinery Manufacturer, 15th Street and Lehigh Avenue, Philadelphia, Pennsylvania.
- WHITE, W. M.**, Hydraulic Engineer, Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin.
- WHITER, E. T.**, Assistant General Manager, Pennsylvania Lines West of Pittsburgh, Pennsylvania Station, Pittsburgh, Pennsylvania.
- WHITNEY, ASA W.**, Metallurgist, in care of Enterprise Foundry and Machine Works, Bristol, Tennessee.
- WHITNEY, CHARLES H.**, Whitney-MacDonald Company, Tioga and Memphis Streets, Philadelphia, Pennsylvania.
- WHITNEY, E. R.**, President, in care of Commercial Truck Company of America, 27th and Brown Streets, Philadelphia, Pennsylvania.
- WHITNEY, FRANK E.**, Mechanical Engineer, in care of Commercial Truck Company of America, 27th and Brown Streets, Philadelphia, Pennsylvania.
- WHITNEY, LOUIS B.**, Manager, Alpha Portland Cement Company, 428 Oliver Building, Pittsburgh, Pennsylvania.
- WHYTE, F. M.**, Vice President, Hutchins Car Roofing Company, New York City, and for mail, 14 Benedict Avenue, Tarrytown, New York.
- WIDDICOMBE, Major, R. A.**, Engineer, 26 North Jefferson Street, Chicago, Illinois.
- WIEDERSHEIM, J. A.**, Patent Attorney and Mechanical Expert, 1232 Chestnut Street, Philadelphia, Pennsylvania.
- WILBUR, W. A.**, Banker, South Bethlehem, Pennsylvania.
- WILEY, H. W.**, Chemist, Room 1120, Woodward Building, Washington, D. C.
- WILKIN, JOHN T.**, President and Engineer, The Connersville Blower Company, and for mail, 905 Grand Avenue, Connersville, Indiana.
- WILLCOX, JAMES M.**, Wawa, Delaware County, Pennsylvania.
- WILLCOX, W. F.**, Darling Post Office, Delaware County, Pennsylvania.
- WILLE, H. V.**, Assistant General Superintendent, The Baldwin Locomotive Works; Consulting Metallurgist, Remington Arms Company of Delaware, Consulting Metallurgist Eddy-stone Ammunition Corporation, and for mail, 500 North Broad Street, Philadelphia, Pennsylvania.
- WILLIAMS, E. D.**, Attorney-at-Law, 560 Drexel Building, Philadelphia, Pennsylvania.
- WILLIAMS, FREDERIC N.**, Refinery Superintendent, Massachusetts Oil Refining Company, East Braintree, Massachusetts.
- WILLIAMS, HENRY S.**, President, Williams, Brown and Earle, Incorporated, 918 Chestnut Street, Philadelphia, Pennsylvania.
- WILLIAMS, IRA JEWELL**, Attorney-at-Law, 1005 Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- WILLIAMS, WILLIAM J.**, Chemist, 1503 Foulkrod Street, Frankford, Philadelphia, Pennsylvania.
- WILLIAMSON, J. D., JR.**, Vice President, American Engineering Company, Latham Park, Oak Lane P. O., Philadelphia, Pennsylvania.
- WILSON, ARTHUR M.**, General Insurance, 706 Stock Exchange Building, Philadelphia, Pennsylvania.
- WILSON, DAVID H.**, Student, 640 North 32nd Street, Philadelphia, Pennsylvania.
- WILSON, DAVID H., JR.**, 253 36th Street, Brooklyn, New York.

- WILSON, H. A., Coronado Apartments, 22nd and Chestnut Streets, Philadelphia, Pennsylvania.
- WILSON, H. D., Coronado Apartments, 22nd and Chestnut Streets, Philadelphia, Pennsylvania.
- WILSON, HENRY W., Civil Engineer, 909 Clinton Street, Philadelphia, Pennsylvania.
- WILSON, J., CLIFFORD, President and Treasurer, J. S. Wilson and Son, Incorporated, Room 205, 1509 Arch Street, Philadelphia, Pennsylvania.
- WILSON, J. HUNT, Professor of Chemistry, Lafayette College, 531 Cattell Street, Easton, Pennsylvania.
- WILSON, J. L., 608 Chestnut Street, Philadelphia, Pennsylvania.
- WILSON, JOHN S., Inspector, 124 South Eutaw Street, Baltimore, Maryland.
- WIRT, CHARLES, President and Engineer, Wirt Company, and for mail, 508 East Washington Lane, Germantown, Philadelphia, Pennsylvania.
- WOLF, JOHN JACOB, 927 North Fifth Street, Philadelphia, Pennsylvania.
- WOOD, ALAN, 3rd, Mechanical Engineer, Flat Rock, North Carolina.
- WOOD, ALBERT C., Consulting Mechanical Engineer, Stock Exchange Building, Philadelphia, Pennsylvania.
- WOOD, BIDDLE, Iron Manufacturer, Conshohocken, Pennsylvania.
- WOOD, C. S., Manufacturer, 212 South 15th Street, Philadelphia, Pennsylvania.
- WOOD, E. R., JR., Mechanical Engineer, 409 Chestnut Street, Philadelphia, Pennsylvania.
- WOOD, F. W., President, Maryland Steel Company, and for mail, Keyworth Avenue, Baltimore, Maryland.
- WOOD, ROBERT L., Civil Engineer, Cruse-Kemper Company, Main Street, Ambler, Pennsylvania.
- WOOD, WALTER, Manufacturer, 400 Chestnut Street, Philadelphia, Pennsylvania.
- WOODBIDGE, J. LESTER, Electrical Engineer, 19th Street and Allegheny Avenue, Philadelphia, Pennsylvania.
- WOODHOUSE, HENRY, Editor, Foster Building, Madison Avenue and 40th Street, New York City, New York.
- WOODROFFE, G. H., Mechanical and Metallurgical Engineer, Parkesburg, Chester County, Pennsylvania.
- WOODWARD, GEORGE, Physician, 708 North American Building, Philadelphia, Pennsylvania.
- WOOLMAN, EDWARD, Mechanical Engineer, N. W. cor. Buck and Panmure Roads, Haverford, Pennsylvania.
- WORRELL, HOWARD SELLERS, Engineer, 100 East Montgomery Avenue, Ardmore, Pennsylvania.
- WRIGHT, FRANK L., Factory Metallurgist, Atlas Ball Company, 4th Street and Glenwood Avenue, Philadelphia, Pennsylvania.
- WRIGHT, ORVILLE, Aeronautical Research Engineer, 15 North Broadway, Dayton, Ohio.
- WRIGHT, ROY V., Editor, 398 North Walnut Street, East Orange, New Jersey.
- WRIGHT, WINTHROP R., Professor of Physics, Swarthmore College, and for mail, 4 Whittier Place, Swarthmore, Pennsylvania.
- WYATT, JAMES H., Electrical Engineer, Cutter Electric and Manufacturing Company, 19th and Hamilton Streets, Philadelphia, Pennsylvania.
- WYCKOFF, A. B., Lieutenant, U. S. N., 131 East H. Street, Ontario, California.
- YARNALL, D. ROBERT, Mechanical Engineer, Chestnut Hill, Philadelphia, Pennsylvania.
- YEOMANS, LUCIEN I., Industrial Engineer, Vice President, Amalgamated Machinery Corporation, 1327-53 West Jackson Street, Chicago, Illinois.
- YORK, H. W., Consulting Engineer, 120 Broadway, New York City, New York.
- YORKE, GEORGE M., Engineer, 70 Irving Place, New York City, New York.
- YOUNG, J. BERTRAM, Chemist, Philadelphia and Reading Railway Company, Reading, Pennsylvania.
- ZEHNDER, CHARLES H., Coal and Iron Merchant, Room 1648, 120 Broadway, New York City, New York.
- ZILEN, VICTOR W., Mechanical Engineer, Route No. 1, Box 139, Chattanooga, Tennessee.
- ZIMMERMANN, JOHN E., Mechanical Engineer, Member of Firm, Day and Zimmermann, 611 Chestnut Street, Philadelphia, Pennsylvania.

MEMBERS WHOSE ADDRESSES ARE UNKNOWN.

- ANDERSON, GEORGE L.
- KNOX, HENRY HOBART
- RUMFORD, WILLIAM C.
- WALKER, J. W.

Important New Scientific Publications

THE MICROSCOPE: Its Design, Construction and Application

A Symposium and General Discussion by Many Authorities

Edited by F. S. SPIERS, B.Sc., F.Inst.P.

Few people realize how much of health and happiness they owe to the microscope, and yet there is probably no other single instrument that has done so much for science and for mankind in general. Here is a comprehensive and valuable book covering the microscope from the earliest times to the present. It is the result of a symposium and general discussion held by The Faraday Society, The Royal Microscopical Society, The Optical Society, and The Photomicrographic Society in coöperation with the Technical Optics Committee of the British Science Guild. Every phase of the construction and development of this invaluable instrument has been thoroughly covered by men who are most competent to do so. Nothing has been omitted, even to future possibilities, and no scientist whose work requires the use of a microscope can afford to be without this extensive collection of papers, presenting as they do the highest sources of information.

260 Pages. Numerous Illustrations. Price, \$5.50.

A TEXT-BOOK ON SURVEYING AND LEVELLING

By H. THRELFALL, M.Sc.Tech., A.R.C.Sc.I.

Here is a very valuable and extensive work designed for the use of architects, civil engineers and surveyors. The author has spared no pains to make this book as complete as possible, and it is the outcome of his practical experience in the field and as a lecturer on the subject for the past twenty years.

679 Pages. With 5 Plates and 282 Diagrams. Price, \$7.00.

THE KILN-DRYING OF LUMBER

By HARRY DONALD TIEMANN, M.E., M.F.

A book that satisfactorily solves the problem of the checking and warping of lumber. A practical and theoretical treatise that contains the most up-to-date information available. The author is the recognized authority in his line.

318 Pages. 54 Illustrations. 9 Plates. 16 Tables. 8vo. Price, \$4.50.

DAIRY CHEMISTRY

By HENRY DROOP RICHMOND, F.I.C.

The increasing demand for this valuable book has rendered necessary the preparation of a new Third Edition, thoroughly revised to meet the changing conditions and to cover the latest researches in dairy chemistry. Such changes have been made as to render it one of the most up-to-date and comprehensive works on the subject.

502 Pages. Numerous Tables and Illustrations. Price, \$8.00.

J. B. LIPPINCOTT COMPANY PUBLISHERS
PHILADELPHIA

INVESTMENT SECURITIES

GRAHAM, PARSONS & Co.

435 CHESTNUT STREET
PHILADELPHIA

30 PINE STREET
NEW YORK

DEAL IN AND PURCHASE
ISSUES OF MUNICIPAL BONDS,
BONDS AND NOTES OF
RAILROADS, UTILITIES
AND INDUSTRIAL CORPORATIONS
OF ESTABLISHED VALUE

CABLE ADDRESS: "GRACO" PHILA.

THE WAY TO WEALTH

By Benjamin Franklin



Copies mailed on request

SAVINGS FUND
DEPARTMENT

Capital

\$5,200,000

Surplus

\$16,000,000

**FIDELITY
TRUST COMPANY**

Philadelphia

325 Chestnut St.

1431 Chestnut St.

6324 Woodland Ave.

AMERICAN PLATINUM WARE

Standard Ware—Made of our specially refined platinum.
Meets the most exacting demands of the laboratory worker.

Complete Catalogue No. 15 on request

AMERICAN PLATINUM WORKS

NEWARK, N. J.

Welsbach Company

GLOUCESTER, N. J.

Manufacturers of

THORIUM NITRATE

and other rare earth chemicals,
including SALTS of

Cerium Lanthanum Neodymium
Zirconium Beryllium Mesothorium

Welsbach Lights & Mantles

COLORS

Acid—Mordant—Basic—Direct—Sulphur

Intermediates
Hydrosulphites

Sizing Materials
Cotton Finishes

Turkey Red Oils
Soluble Oils

OFFERED BY

H. A. METZ & CO., Inc.

Boston
Philadelphia
Chicago

122 Hudson Street
New York

Charlotte
San Francisco
Providence

THE JOHN T. DYER QUARRY CO.

BUSINESS ESTABLISHED 1891

BIRDSBORO TRAPPE ROCK

**HARRISON BUILDING
PHILADELPHIA**

ALAN WOOD IRON & STEEL CO.



PHILADELPHIA

PIG IRON

BILLETS, BLOOMS AND SLABS

SHEARED PLATES

ROLLED STEEL FLOOR PLATES

BLUE ANNEALED STEEL SHEETS

ELECTRICAL TESTING LABORATORIES

Electrical and Mechanical Laboratories

Tests of Electrical Machinery, Apparatus and Supplies,
Materials of Construction. Coal, paper, etc. Inspection
of Material and Apparatus at Manufactories.

80th St. and East End Ave.

New York

HENRY BOWER
Chemical Manufacturing Company
YELLOW PRUSSIATES

**SODIUM
CALCIUM**

PHILADELPHIA

PENNSYLVANIA

JOHN J. GRIFFIN & CO.

Manufacturers of

GAS METERS
AND APPARATUS

Repairing Promptly Attended to

No. 1513 to 1521 Race Street
PHILADELPHIA

BLACK DIAMOND FILE WORKS

Twelve Medals
Awarded at Inter-
national Expositions

Special Prize
Gold Medal

at Atlanta, Ga., 1895



**G. & H.
BARNETT
COMPANY**
Philadelphia, Pa.
Owned and Operated by
NICHOLSON FILE CO.

See our exhibit in the Bourse, Fifth near Market Street, Philadelphia
Copy of Catalogue will be sent free to any interested file-user upon application.





34y
722 The Franklin Institute

OF THE

STATE OF PENNSYLVANIA

TRANSPORTATION LIBRARY

1922 YEAR BOOK

UNIVERSITY OF MICHIGAN LIBRARIES

NOW READY

The Physics of the Air

By **WILLIAM J. HUMPHREYS, Ph.D.**

*Professor of Meteorological Physics
United States Weather Bureau*

A rational and deductive treatise on the physics of the atmosphere. Of great value to meteorologists, physicists and the aviator.

678 Pages, Illustrations, Index, 8vo.

Price, \$5.00

Carriage extra.

Address orders and inquiries to

THE FRANKLIN INSTITUTE

PHILADELPHIA, U.S.A.

NOW READY

The Physics of the Air

By **WILLIAM J. HUMPHREYS, Ph.D.**

*Professor of Meteorological Physics
United States Weather Bureau*

A rational and deductive treatise on the physics of the atmosphere. Of great value to meteorologists, physicists and the aviator.

678 Pages, Illustrations, Index, 8vo.

Price, \$5.00

Carriage extra.

Address orders and inquiries to

THE FRANKLIN INSTITUTE

PHILADELPHIA, U.S.A.



BENJAMIN FRANKLIN

VENERATED FOR BENEVOLENCE, ADMIRER FOR TALENTS, ESTEEMED
FOR PATRIOTISM, BELOVED FOR PHILANTHROPY.

—(*Washington.*)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

FOUNDED 1824

Year Book—1922

PHILADELPHIA

HALL OF THE INSTITUTE

15 SOUTH SEVENTH STREET

SEPTEMBER 1, 1922



BENJAMIN FRANKLIN

VENERATED FOR BENEVOLENCE, ADMIRER FOR TALENTS, ESTEEMED
FOR PATRIOTISM, BELOVED FOR PHILANTHROPY.

—(*Washington.*)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

FOUNDED 1824

Year Book—1922

PHILADELPHIA

HALL OF THE INSTITUTE

15 SOUTH SEVENTH STREET

SEPTEMBER 1, 1922

Transportation
Library

1
534
112

TELEPHONES

Bell, . . Lombard 6847

Keystone, . Main 6641

CONTENTS

| | PAGE |
|---|------|
| OFFICERS AND COMMITTEES, 1922 | 5 |
| PAST OFFICERS, 1824-1922 | 11 |
| PAST CHAIRMEN, COMMITTEE ON SCIENCE AND THE ARTS, 1834-1922 . . . | 17 |
| THE INSTITUTE'S ACTIVITIES | 18 |
| SOME INSTANCES OF THE INSTITUTE'S WORK | 25 |
| CHARTER AND BY-LAWS | 29 |
| AWARDS BY THE INSTITUTE | 45 |
| REGULATIONS OF THE COMMITTEE ON SCIENCE AND THE ARTS | 51 |
| ANNUAL REPORTS | 61 |
| THE FRANKLIN INSTITUTE AWARDS, 1921-'22 | 92 |
| THE FRANKLIN INSTITUTE AWARDS, 1835-1922 | 94 |
| TERMS AND PRIVILEGES OF MEMBERSHIP | 137 |
| MEMBERSHIP DIRECTORY | 138 |

OFFICERS AND COMMITTEES, 1922

PRESIDENT

WALTON CLARK

VICE-PRESIDENTS

W. C. L. EGLIN

CHARLES DAY

HENRY HOWSON

SECRETARY

R. B. OWENS

TREASURER

BENJAMIN FRANKLIN

BOARD OF TRUSTEES

JOHN HAMPTON BARNES, President

W. L. AUSTIN

JOHN GRIBBEL

CHARLES E. BRINLEY

ALFRED C. HARRISON

WALTON CLARK

FREDERIC ROSENGARTEN

BOARD OF MANAGERS*

GELLERT ALLEMAN

GEORGE A. HOADLEY

CHARLES E. BONINE

HARRY F. KELLER

FRANCIS T. CHAMBERS

ROBERT W. LESLEY

G. H. CLAMER

EDW. V. McCAFFREY

THEOBALD F. CLARK

MARSHALL S. MORGAN

W. C. L. EGLIN

LAWRENCE T. PAUL

WALTON FORSTALL

JAMES S. ROGERS

BENJAMIN FRANKLIN

GEORGE D. ROSENGARTEN

CLARENCE A. HALL

E. H. SANBORN

ALFRED C. HARRISON

HASELTINE SMITH

NATHAN HAYWARD

C. C. TUTWILER

CHARLES A. HEXAMER

WILLIAM CHATTIN WETHERILL

*The President, Vice-Presidents, Secretary, Treasurer and the Chairman of the Committee on Science and the Arts are ex-officio members of the Board of Managers.

ARCHITECT

JOHN T. WINDRIM

STAFF

R. B. OWENS, D.S.O., D.Sc., E.E., M.A., F.R.S.C.

Secretary; Editor of the *JOURNAL OF THE FRANKLIN INSTITUTE*; Director, The Bartol Research Foundation.

ALFRED RIGLING

Librarian; Assistant Editor, *JOURNAL OF THE FRANKLIN INSTITUTE*.

T. R. PARRISH, B.E.

Actuary; Director School of Mechanic Arts; Assistant to the Director, The Bartol Research Foundation.

GEORGE A. HOADLEY, C.E., Sc.D.

Assistant to the Committee on Science and the Arts.

ANN B. HUDSON

Executive Assistant to the Secretary.

WALTER A. R. PERTUCH

Assistant Librarian; Superintendent of Building.

MARY L. COFFIN

Secretary to Science and the Arts Assistant.

NELLIE E. PATTON

Secretary to the Director, Bartol Research Foundation.

GERTRUDE I. DAISEY

Bookkeeper.

HAZEL V. SLAW

Secretary to Librarian.

EMMA EWING

Cataloguer.

MARY B. COBLE

Telephone Operator.

RAYMOND A. M. SHULTZ

Office Assistant.

S. NELSON TOTTEN

Library Clerk.

COMMITTEES OF THE BOARD OF MANAGERS

COMMITTEE ON ELECTION AND RESIGNATION OF MEMBERS

ROBERT W. LESLEY, Chairman
GELLERT ALLEMAN

CLARENCE A. HALL
MARSHALL S. MORGAN

COMMITTEE ON ENDOWMENT

G. H. CLAMER, Chairman
ALFRED C. HARRISON

NATHAN HAYWARD
WILLIAM C. WETHERILL

EXECUTIVE COMMITTEE

E. H. SANBORN, Chairman
CHARLES DAY

WALTON FORSTALL
ALFRED C. HARRISON

COMMITTEE ON EXHIBITIONS

BENJAMIN FRANKLIN, Chairman.
FRANCIS T. CHAMBERS
THEOBALD F. CLARK

CHARLES DAY
CHARLES A. HEXAMER

FRANKLIN FUND AND BUILDING COMMITTEE

HENRY HOWSON, Chairman

WALTON CLARK, Treasurer
ALFRED C. HARRISON

COMMITTEE ON INSTRUCTION

LAWRENCE T. PAUL, Chairman
GEO. A. HOADLEY
HARRY F. KELLER

EDW. V. MCCAFFREY
JAMES S. ROGERS

Officers of Instruction

T. R. Parrish, Director
R. E. Brown
G. W. H. Fawkes
H. H. Fox
Theodore G. Grier
Frederick Miller
James G. Morgan

W. Earl Neilson
B. A. Owen
William S. Owen
I. P. Pedrick
Clement Remington
A. J. Stretton
B. W. Taylor

STAFF

R. B. OWENS, D.S.O., D.Sc., E.E., M.A., F.R.S.C.

Secretary; Editor of the JOURNAL OF THE FRANKLIN INSTITUTE; Director, The Bartol Research Foundation.

ALFRED RIGLING

Librarian; Assistant Editor, JOURNAL OF THE FRANKLIN INSTITUTE.

T. R. PARRISH, B.E.

Actuary; Director School of Mechanic Arts; Assistant to the Director, The Bartol Research Foundation.

GEORGE A. HOADLEY, C.E., Sc.D.

Assistant to the Committee on Science and the Arts.

ANN B. HUDSON

Executive Assistant to the Secretary.

WALTER A. R. PERTUCH

Assistant Librarian; Superintendent of Building.

MARY L. COFFIN

Secretary to Science and the Arts Assistant.

NELLIE E. PATTON

Secretary to the Director, Bartol Research Foundation.

GERTRUDE I. DAISEY

Bookkeeper.

HAZEL V. SLAW

Secretary to Librarian.

EMMA EWING

Cataloguer.

MARY B. COBLE

Telephone Operator.

RAYMOND A. M. SHULTZ

Office Assistant.

S. NELSON TOTTEN

Library Clerk.

COMMITTEES OF THE BOARD OF MANAGERS

COMMITTEE ON ELECTION AND RESIGNATION OF MEMBERS

ROBERT W. LESLEY, Chairman
GELLERT ALLEMAN

CLARENCE A. HALL
MARSHALL S. MORGAN

COMMITTEE ON ENDOWMENT

G. H. CLAMER, Chairman
ALFRED C. HARRISON

NATHAN HAYWARD
WILLIAM C. WETHERILL

EXECUTIVE COMMITTEE

E. H. SANBORN, Chairman
CHARLES DAY

WALTON FORSTALL
ALFRED C. HARRISON

COMMITTEE ON EXHIBITIONS

BENJAMIN FRANKLIN, Chairman.
FRANCIS T. CHAMBERS
THEOBALD F. CLARK

CHARLES DAY
CHARLES A. HEXAMER

FRANKLIN FUND AND BUILDING COMMITTEE

HENRY HOWSON, Chairman

WALTON CLARK, Treasurer

ALFRED C. HARRISON

COMMITTEE ON INSTRUCTION

LAWRENCE T. PAUL, Chairman
GEO. A. HOADLEY
HARRY F. KELLER

EDW. V. MCCAFFREY
JAMES S. ROGERS

Officers of Instruction

T. R. Parrish, Director
R. E. Brown
G. W. H. Fawkes
H. H. Fox
Theodore G. Grier
Frederick Miller
James G. Morgan

W. Earl Neilson
B. A. Owen
William S. Owen
I. P. Pedrick
Clement Remington
A. J. Stretton
B. W. Taylor

COMMITTEE ON PUBLICATIONS

GEORGE D. ROSENGARTEN, Chairman

GEORGE A. HOADLEY

G. H. CLAMER

E. H. SANBORN

W. C. L. EGLIN

Editorial Staff of the Journal

R. B. OWENS, Editor

Associate Editors

Brig. Gen. James Allen

Gaetano Lanza

Joseph S. Ames

Ralph Modjeski

Wilder D. Bancroft

L. A. Osborne

Brig. Gen. John J. Carty

Albert Sauveur

A. S. Cushman

Maj. Gen. Geo. O. Squier

Arthur L. Day

C. P. Steinmetz

A. S. Eve

S. W. Stratton

W. J. Humphreys

Chief Con. D. W. Taylor, U.S.N.

Harry F. Keller

R. S. Woodward

A. E. Kennelly

A. F. Zahm

COMMITTEE ON SECTIONAL ARRANGEMENTS

HARRY F. KELLER, Chairman

HASELTINE SMITH

GELLERT ALLEMAN

C. C. TUTWILER

ROBERT W. LESLEY

COMMITTEE ON STOCKS AND FINANCE

WALTON FORSTALL, Chairman

JAMES S. ROGERS

BENJAMIN FRANKLIN

E. H. SANBORN

ALFRED C. HARRISON

COMMITTEES OF THE INSTITUTE

COMMITTEE ON LIBRARY

CLARENCE A. HALL, Chairman
CHARLES E. BONINE
G. H. CLAMER
H. J. M. CREIGHTON
W. H. FULWEILER

GEORGE A. HOADLEY
HARRY F. KELLER
C. W. MASLAND
MARSHALL S. MORGAN
GEORGE F. STRADLING

COMMITTEE ON MEETINGS

GELLERT ALLEMAN, Chairman
JOSEPH S. AMES
G. H. CLAMER
ALLERTON S. CUSHMAN
ARTHUR L. DAY

W. H. FULWEILER
HERBERT E. IVES
A. E. KENNELLY
RALPH MODJESKI
GEO. D. ROSENGARTEN

COMMITTEE ON MUSEUM

A. E. OUTERBRIDGE, Jr., Chairman
HUGO BILGRAM
ARTHUR L. CHURCH
CHARLES DAY
W. C. L. EGLIN

GEORGE A. HOADLEY
C. W. MASLAND
CHARLES PENROSE
H. H. QUIMBY

BARTOL RESEARCH FOUNDATION COMMITTEE

CHARLES DAY, Chairman
JOSEPH S. AMES
WALTON CLARK
ARTHUR L. DAY

MARSHALL S. MORGAN
R. B. OWENS
C. C. TUTWILER

LABORATORY BUILDING COMMITTEE

NATHAN HAYWARD, Chairman
WALTON CLARK
CHARLES DAY

HENRY HOWSON
R. B. OWENS

COMMITTEE ON SCIENCE AND THE ARTS**JAMES BARNES, Chairman**

HENRY B. ALLEN

GEORGE H. BENZON, JR.

HUGO BIGRAM

CARL P. BIRKINBINE

CHARLES E. BONINE

ROGER F. BRUNEL

HAROLD CALVERT

G. H. CLAMER

EDWARD L. CLARK

THEOBALD F. CLARK

THOMAS D. COPE

GEORGE S. CRAMPTON

H. J. M. CREIGHTON

J. A. P. CRISFIELD

GEORGE S. CULLEN

P. T. DASHIELL

SAMUEL B. ECKERT

W. C. L. EGLIN

OWEN B. EVANS

BENJAMIN FRANKLIN

WALTER H. FULWEILER

CLARENCE A. HALL

NATHAN HAYWARD

JOSEPH S. HEPBURN

CARL HERING

GEORGE A. HOADLEY

S. C. HOLLISTER

CHARLES D. GALLOWAY

HERBERT E. IVES

W. N. JENNINGS

HARRY F. KELLER

LIONEL F. LEVY

PAUL A. LEWIS

LEO LOEB

EDWARD V. McCAFFREY

J. Y. McCONNELL

K. G. MACKENZIE

CHARLES WM. MASLAND

STEPHEN H. NOYES

CHARLES PENROSE

M. M. PRICE

H. H. QUIMBY

FRANK ROGERS

JAMES S. ROGERS

L. F. RONDINELLA

J. M. RUSBY

RICHARD C. SELLERS

JOHN P. B. SINKLER

WILLIAM H. THORNE

JOHN C. TRAUTWINE, 3rd

C. C. TUTWILER

JAMES G. VAIL

JOHN A. VOGLESON

FRANCIS R. WADLEIGH

JOHN M. WEISS

WM. CHATTIN WETHERILL

ROBERT L. WOOD

Standing Sub-Committees**The Franklin Medal****HARRY F. KELLER, Chairman**

JAMES BARNES

G. H. CLAMER

H. J. M. CREIGHTON

Literature**THOMAS D. COPE, Chairman**

CHARLES E. BONINE

W. H. FULWEILER

HARRY F. KELLER

J. M. RUSBY

New Subjects and Preliminary Examination**H. J. M. CREIGHTON, Chairman**

CHARLES E. BONINE

GEORGE S. CRAMPTON

BENJAMIN FRANKLIN

NATHAN HAYWARD

LIONEL F. LEVY

CHARLES PENROSE

M. M. PRICE

JAMES S. ROGERS

PAST OFFICERS

1824-1922

PRESIDENTS

| | |
|--------------------------------|-------------------------------|
| BANES, CHARLES H., 1886 | ROGERS, ROBERT E., 1875-1878 |
| BIRKINBINE, JOHN, 1897-1906 | RONALDSON, JAMES, 1824-1841 |
| CLARK, WALTON, 1907- | SELLERS, COLEMAN, 1870-1874 |
| CRESSON, JOHN C., 1855-1863 | SELLERS, WILLIAM, 1864-1866 |
| MERRICK, J. VAUGHAN, 1867-1869 | TATHAM, WILLIAM P., 1879-1885 |
| MERRICK, SAMUEL V., 1842-1854 | WILSON, JOSEPH M., 1887-1896 |

VICE-PRESIDENTS

| | |
|--|--------------------------------------|
| AGNEW, JOHN, 1851, 1855-1863 | HEYL, HENRY R., 1895-1897 |
| BALDWIN, MATTHIAS W., 1855-1863 | HOWSON, HENRY, 1904- |
| BECK, PAUL, JR., 1826-1827 | JONES, WASHINGTON, 1900-1910 |
| BULLOCK, CHARLES, 1879-1900 | LEVY, LOUIS E., 1916-1919 |
| CAREY, MATTHEW, 1824-1828 | LONGSTRETH, EDWARD, 1890-1894 |
| CARTWRIGHT, HENRY, 1880-1881 | LUKENS, ISAIAH, 1824-1825, 1829-1846 |
| CHRISTIE, JAMES, 1911 | MILLER, ABRAHAM, 1847-1854 |
| CLOSE, CHARLES S., 1875-1879 | MITCHELL, J. E., 1876-1887 |
| CRESSON, GEORGE V., 1898-1903 | MOORE, BLOOMFIELD H., 1869-1876 |
| DAY, CHARLES, 1920- | MORRIS, HENRY G., 1870-1879 |
| DODGE, JAMES M., 1903-1915 | RAND, THEODORE D., 1897-1903 |
| EGLIN, W. C. L., 1922- | ROGERS, FAIRMAN, 1864-1866 |
| EREBY, GEORGE, 1867 | ROGERS, ROBERT E., 1868-1874 |
| FLETCHER, THOMAS, 1828-1850, 1852-1854 | SELLERS, COLEMAN, 1867-1869 |
| FRAZER, JOHN F., 1865-1866 | SELLERS, COLEMAN, JR., 1912-1922 |
| GRAFF, FREDERICK, 1882-1890 | TATHAM, WILLIAM P., 1888-1897 |
| | TOWNE, JOHN H., 1864-1868 |

RECORDING SECRETARIES

| | |
|--------------------------------------|--------------------------------|
| BULKLEY, JAMES H., 1831-1832 | PEROT, WILLIAM S., 1833-1834 |
| GARRIGUES, ISAAC B., 1830, 1837-1863 | ROBERTS, ALGERNON S., 1829 |
| JONES, THOMAS P., 1827-1828 | STRICKLAND, WILLIAM, 1824-1826 |
| JONES, WASHINGTON, 1864 | TRAUTWINE, JOHN C., 1835-1836 |

CORRESPONDING SECRETARIES

| | |
|--------------------------------|--------------------------------|
| BACHE, ALEX. DALLAS, 1840-1844 | FRALEY, FREDERICK, 1855-1863 |
| BRIGGS, ROBERT, 1864 | FRAZER, JOHN F., 1845-1847 |
| BROWNE, PETER A., 1824-1827 | HAYS, ISAAC, 1828-1839 |
| CRESSON, JOHN C., 1854 | ROBERTS, SOLOMON W., 1848-1853 |

SECRETARIES

CHRISTIE, JAMES, 1909
 KNIGHT, J. B., 1875-1879
 MORTON, HENRY, 1865-1870
 NORRIS, ISAAC, 1879-1881

OWENS, ROBERT B., 1910-
 WAHL, WILLIAM H., 1871-1874, 1882-
 1908

TREASURERS

FORNER, CYRUS, 1908-1920
 FLETCHER, THOMAS, 1824-1825
 FRALEY, FREDERICK, 1830-1847, 1865-
 1882
 FRANKLIN, BENJAMIN, 1920-
 FRAZER, JOHN F., 1848-1864

MERRICK, SAMUEL V., 1828-1829
 RICHARDSON, JOHN, 1826-1827
 SARTAIN, SAMUEL, 1883-1906
 TREGO, CHARLES B., 1847
 WAHL, WILLIAM H., 1907

ACTUARIES

CHRISTIE, JAMES, Feb. 21-June 11,
 1908
 HAMILTON, WILLIAM, 1828-1871
 HEYL, HERBERT L., 1885-1908
 HOLMAN, DAVID S., 1872-1885

JESTER, SIMEON VAN T., 1916-1918
 LARZELERE, JAMES S., 1908-1916
 PARRISH, T. R., 1922-
 ROBINSON, LOUIS C., 1918-1922
 WAHL, WILLIAM H., 1872

LIBRARIANS

HILTEBRAND, EMANUEL, 1874-1887

RIGLING, ALFRED, 1887-

MANAGERS

ABBOT, WILLIAM, 1824-1826
 ADAMSON, WILLIAM, 1864
 ADDICKS, JOHN E., 1845-1850
 AGNEW, JOHN, 1831-1850, 1852-1854
 ALLEMAN, GELLERT, 1918-
 ALLEN, JAMES, 1845
 ALLISON, WILLIAM C., 1863
 ARCHER, ELLIS S., 1858-1859
 BACHE, ALEX. DALLAS, 1830-1839
 BALCH, EDWIN S., 1902-1912
 BALDWIN, MATTHIAS W., 1827-1854
 BANES, CHARLES H., 1877-1885,
 1887-1895
 BARKER, GEORGE F., 1874-1875
 BARRAS, JOSEPH J., 1851-1860
 BARTOL, BARNABAS H., 1863-1865
 BARTOL, HENRY W., 1870-1878
 BAUGH, DANIEL, 1900-1902

BAUGH, HARMAN, 1855
 BEALE, JOSEPH, 1827
 BEARDSLEY, ARTHUR, 1894-1902
 BECK, PAUL, JR., 1824-1825
 BEMENT, CLARENCE S., 1871
 BEMENT, WILLIAM B., 1866-1870
 BERGNER, THEODORE, 1870-1875
 BETTS, WILLIAM C., 1844
 BIDDLE, CLEMENT C., 1824
 BILGRAM, HUGO, 1885-1890
 BIRKBECK, JOHN, 1869-1871
 BIRKINBINE, HENRY P. M., 1851-1856
 BIRKINBINE, JOHN, 1907-1915
 BOLTON, JAMES M., 1830
 BONINE, CHARLES E., 1921-
 BORNER, CYRUS, 1903-1907
 BOSWELL, WILLIAM L., 1896-1898
 BOWER, HENRY, 1891-1896

MANAGERS—(Continued)

- BRIGGS, ROBERT, 1867-1873
 BROCK, ROBERT C. H., 1901-1906
 BROLASKY, HENRY C., 1897-1902
 BRYSON, JAMES H., 1857-1863
 BULKLEY, JAMES H., 1830, 1833-1841
 BULLOCK, CHARLES, 1868-1878
 BURNHAM, GEORGE, 1878
 BURTIS, AARON H., 1845
 CARR, WILLIAM H., 1837-1845
 CARTWRIGHT, HENRY, 1865-1879
 CHABOT, CYPRIEN, 1877-1889
 CHAMBERS, CYRUS, JR., 1876-1890
 CHAMBERS, FRANCIS T., 1913-
 CHASE, PLINY E., 1864-1886
 CHRISTIE, JAMES, 1897-1908
 CLAMER, G. H., 1917-
 CLARK, THEOBALD F., 1917-
 CLARK, WALTON, 1903-1906
 CLARKE, JAMES, 1824-1826
 CLOSE, CHARLES S., 1865-1874
 CLOUD, JOSEPH, 1824
 CODMAN, JOHN E., 1892-1894
 COLLINS, ISAAC, 1828
 CONARD, THOMAS P., 1894-1908
 CONARROE, GEORGE W., 1851-1863
 COOPER, JOHN H., 1870-1873
 COPPER, JOHN C., 1851
 CORNELIUS, ROBERT, 1855-1863
 CORNELIUS, ROBERT C., 1866-1868
 CRAMP, CHARLES H., 1864-1867,
 1875, 1895-1897
 CRESSON, GEORGE V., 1886-1897
 CRESSON, JOHN C., 1835-1853
 CRESSON, WILLIAM P., 1848-1849
 DARRACH, CHARLES G., 1894-1896
 DAY, CHARLES, 1908-1919
 DIVINE, WILLIAM, 1864
 DODGE, KERN, 1916-1920
 DODGE, JAMES M., 1896-1903
 DONALDSON, JOSEPH, 1825
 DOUGHERTY, JAMES, 1858-1861
 DRAPER, EDMUND, 1847-1850
 DREER, FERDINAND J., 1862
 DROWN, WILLIAM A., 1861-1863
 DU BOIS, WILLIAM L., 1880-1882
 DURFEE, WILLIAM F., 1872-1873
 EASTWICK, ANDREW M., 1836-1844
 EASTWICK, EDWARD P., 1859-1860
 EBERT, MORRIS, 1908-1911
 ECKERT, GEORGE M., 1852-1854
 EGLIN, W. C. L., 1908-1922
 EISENHUT, JOHN D., 1824-1825
 ELDRIDGE, G. MORGAN, 1885-1890
 ELLIS, JAMES P., 1848-1851
 EMERSON, G., 1828
 EREBY, GEORGE, 1854-1866
 EVANS, OWEN, 1844-1857
 FARR, GEORGE W., 1851
 FERGUSON, ALEXANDER, 1831-1841
 FLETCHER, THOMAS, 1826-1827
 FLING, WILLIAM B., 1842
 FORSTALL, WALTON, 1908-
 FOX, GEORGE, 1828-1830
 FRALEY, FREDERICK, 1829, 1848-1854
 FRANKLIN, BENJAMIN, 1917-
 FRAZER, JOHN F., 1844, 1865-1866
 FRAZER, PERSIFOR, 1880-1891, 1903-1909
 FRAZIER, GEORGE H., 1898
 FRENCH, HOWARD B., 1900
 FRY, WILLIAM, 1825
 GARDINER, JOHN, JR., 1864
 GARRIGUES, ISAAC B., 1825-1829, 1831-
 1836
 GARRISON, F. LYNWOOD, 1890-1895,
 1897-1903
 GAWTHROP, HENRY, 1896-1898
 GIBBS, ALFRED W., 1915-1922
 GIBSON, J. HOWARD, 1893-1894
 GIBSON, JOHN J., 1912-1915
 GILDER, JOHN, 1838-1841
 GILPIN, THOMAS, 1824
 GOBRECHT, CHRISTIAN, 1828-1830
 GOLDSMITH, E., 1908-1916
 GRAHAM, HOWARD S., 1920-1921

MANAGERS—(Continued)

- GRAFF, FREDERICK, 1852-1854, 1858-1865, 1880-1881
 GREBLE, EDWIN, 1841-1863
 GREENE, STEPHEN, 1898-1908
 GRIES, JOHN M., 1858-1862
 GRIFFITH, R. EGGLESFIELD, 1870-1871
 GRIFFITH, ROBERT E., 1827
 GROVES, DANIEL, 1824-1827
 HALL, CLARENCE A., 1922-
 HAND, JAMES C., 1845-1846
 HANSELL, WILLIAM S., 1827
 HARDING, GEORGE, 1864-1865
 HARKER, JOSHUA G., 1831-1836
 HARPER, JAMES, 1824-1826
 HARRIS, WILLIAM, 1860-1863
 HARRISON, ALFRED C., 1895-
 HARRISON, C. LELAND, 1899-1902
 HARRISON, JOHN, 1824-1829
 HARRISON, JOSEPH, JR., 1854, 1856-1859
 HART, SAMUEL, 1865-1870
 HAVILAND, JOHN, 1824-1826
 HAYS, ISAAC, 1840-1841
 HAYWARD, NATHAN, 1917-
 HELLER, CHARLES S., 1879-1880
 HELME, WILLIAM, 1869-1888
 HENDERSON, GEORGE R., 1915-1921
 HERSE, GEORGE P., 1851
 HEXAMER, CHARLES A., 1904-
 HEYL, HENRY R., 1879-1895, 1898-1909
 HOADLEY, GEORGE A., 1911-
 HORN, HENRY, 1824
 HORSTMANN, WILLIAM J., 1865-1868
 HOUSTON, EDWIN J., 1874-1897
 HOWARD, GEORGE C., 1855-1858
 HOWE, HERBERT M., 1898-1900
 HOWSON, CHARLES HENRY, 1903-1907
 HOWSON, HENRY, 1898-1903
 HUFTY, SAMUEL, 1834-1850
 HUMPHREYS, SAMUEL, 1826
 HUNTER, JAMES, 1864
 HUTCHINSON, CHARLES H., 1888-1890
 HUTCHINSON, JAMES, 1841-1842
 HUTCHINSON, JOSEPH, 1860-1863
 JAYNE, HARRY W., 1891-1910
 JENNINGS, W. N., 1896
 JOHNSON, LAWRENCE, 1855-1859
 JONES, THOMAS P., 1826
 JONES, WASHINGTON, 1859-1895, 1897-1900
 KATEZ, I., 1824
 KEATING, WILLIAM H., 1824-1826, 1830-1840
 KELLER, HARRY F., 1914-
 KELLY, HENRY H., 1851
 KING, ROBERT P., 1851
 KIRK, CHARLES H., 1830
 KIRKPATRICK, GEORGE E., 1911-1914
 KNEASS, WILLIAM, 1825
 KNIGHT, DANIEL R., 1845
 KRUMBHAAR, ALEXANDER, 1898-1911
 KUHN, C. HARTMAN, 1896-1905
 LAMBERT, WM. H., 1906
 LESLEY, ROBERT W., 1913-
 LE VAN, W. BARNET, 1864-1876
 LEVY, LOUIS E., 1903-1915
 LEWIS, ENOCH, 1868-1894
 LEWIS, HARVEY, 1824-1827
 LEWIS, MORDECAI D., 1828-1836
 LINDSAY, JOHN, 1843
 LINDSAY, ROBERT, 1834-1836
 LINNARD, JAMES M., 1836-1838
 LINVILLE, J. HAYES, 1868
 LONGSTRETH, CHARLES, 1903-1907
 LONGSTRETH, EDWARD, 1868-1870, 1895-1897
 LOUD, THOMAS, 1829-1831
 LOVE, WILLIAM H., 1859
 LUCAS, JOHN, 1888-1894
 LUKENS, ISAIAH, 1828
 LUKENS, JAWOOD, 1902-1908
 LYMAN, BENJAMIN S., 1901-1902
 McALPINE, JAMES, 1825-1828
 McCaffrey, E. V., 1910-
 McCAMBRIDGE, RICHARD, 1876
 McClure, JOHN, 1853-1856
 McClurg, ALEXANDER, 1833-1839

MANAGERS—(Continued)

- MCEUEN, THOMAS, 1829
 MCKEAN, WILLIAM V., 1879-1883
 MARKS, WILLIAM D., 1881-1884
 MARSHALL, SAMUEL R., 1887-1893
 MASON, DAVID H., 1824
 MASON, JAMES S., 1861
 MEGARGEE, CHARLES, 1858
 MEIRS, RICHARD WALN, 1908-1917
 MERRICK, J. VAUGHAN, 1864-1866,
 1870-1884
 MERRICK, SAMUEL V., 1824-1827,
 1830-1841, 1855-1863
 MIFFLIN, LLOYD, 1825-1826
 MILES, FREDERICK B., 1874
 MILLER, ABRAHAM, 1824-1846, 1855-
 1858
 MITCHELL, J. E., 1874
 MITCHELL, WILLIAM A., 1864-1865
 MORRIS, ISAAC P., 1836-1843
 MOORE, BLOOMFIELD H., 1864-1868
 MOORE, JOSEPH W., 1860-1861
 MORGAN, MARSHALL S., 1914-
 MORRIS, ELWOOD, 1844-1847
 MORRIS, HENRY G., 1864-1869
 MORRIS, WILLIAM E., 1847-1851
 MUCKLE, M. RICHARDS, JR., 1894-1896
 NAYLOR, JACOB, 1863, 1865-1872
 NEAFIE, JACOB G., 1868
 NEWHALL, PAUL W., 1843-1844
 NORRIS, ISAAC, 1870-1878, 1883-1918.
 NYSTROM, JOHN W., 1873-1875
 OGDEN, JOHN M., 1833
 OGLE, WILLIAMS, 1845-1850
 O'NEILL, JOHN, 1827-1832
 ORR, HECTOR, 1871-1887
 OUTERBRIDGE, ALEX. E., JR., 1881-1886
 PALMER, B. FRANKLIN, 1862
 PARRISH, WILLIAM D., 1838, 1852-
 1854
 PARRY, CHARLES T., 1864
 PATTERSON, ROBERT, 1824
 PATTERSON, ROBERT M., 1825-1827
 PAUL, LAWRENCE T., 1895-
 PEMBERTON, HENRY, JR., 1891-1896
 PERRY, ROBERT S., 1912-1916
 PETTIT, HORACE, 1894-1910
 PURVES, ALEXANDER, 1875-1876
 RALSTON, ASHBEL G., 1825-1830
 RAMAGE, ADAM, 1824-1832
 RAND, THEODORE D., 1874-1897
 REED, WILLIAM B., 1832-1836
 REEVES, BENJAMIN, 1829-1837
 REEVES, SAMUEL J., 1864
 REEVES, STACY, 1889-1902
 RICE, JOHN, 1866-1867
 RICHARDS, MARK, 1831
 RICHARDSON, JOHN, 1825
 RIEHLE, HENRY J., 1826-1827
 ROBBINS, SAMUEL J., 1827-1833
 ROBERTS, ALGERNON S., 1828
 ROBERTS, PERCIVAL, 1864-1868
 ROBERTS, SOLOMON W., 1842-1847
 ROBINSON, ALEXANDER P., 1911-1916
 ROGERS, EVANS, 1854-1863
 ROGERS, HENRY D., 1838-1843
 ROGERS, JAMES S., 1909-
 ROGERS, ROBERT E., 1867
 RONALDSON, CHARLES E., 1885-1893,
 1908-1912
 ROSENGARTEN, GEORGE D., 1912-
 ROWLAND, JAMES, JR., 1829-1830
 ROWLAND, WILLIAM, 1828
 RUSH, WILLIAM, 1825
 RUST, JAMES I., 1824
 SADTLER, SAMUEL P., 1888-1897
 SANBORN, E. H., 1907-
 SARTAIN, JOHN, 1877-1879
 SARTAIN, SAMUEL, 1865-1882
 SAVERY, PELEG B., 1851-1852
 SAXTON, JOSEPH, 1842-1844
 SAY, BENJAMIN, 1832-1833
 SCATTERGOOD, THOMAS, 1829-1834
 SCHAUM, OTTO W., 1907
 SCHREINER, JOSEPH H., 1827-1832

MANAGERS—(Continued)

- SCHUMANN, FRANCIS, 1899-1902
 SEIPER, THOMAS, 1824
 SELLERS, COLEMAN, 1862-1866, 1875-1905
 SELLERS, COLEMAN, JR., 1906-1911
 SELLERS, WILLIAM, 1857-1861, 1867-1892
 SHAIN, CHARLES J., 1884-1887
 SHINN, EARLE, 1836-1837
 SLOAN, SAMUEL, 1864
 SMITH, CHARLES E., 1852-1855
 SMITH, HASELTINE, 1922-
 SOUDER, JACOB, 1828
 SPANGLER, HENRY W., 1891-1893
 STEVENSON, WILLIAM, JR., 1828
 STEWART, THOMAS S., 1842-1850, 1852-1863
 STRICKLAND, WILLIAM, 1828
 STRUTHERS, JOHN, 1827-1849
 TABER, GEORGE, 1839-1842
 TATHAM, WILLIAM P., 1870-1878, 1886-1887
 THOMPSON, AMBROSE W., 1839-1843
 THOMSON, ELIHU, 1878-1881
 THORNE, WILLIAM H., 1881-1897
 THORNLEY, JOHN, 1851
 TILGHMAN, BENJ. C., 1871-1875
 TOPPAN, CHARLES, 1831-1832
 TOWNE, JOHN H., 1840-1857, 1869
 TOWNSEND, EDWARD Y., 1866-1867
 TRACY, ELIASHIB, 1851
 TRAUTWINE, JOHN C., 1834, 1844, 1852-1857
 TRAUTWINE, JOHN C., JR., 1891-1895
 TREGO, CHARLES B., 1837-1846
 TREVOR, JOHN B., 1832
 TROTH, HENRY, 1837-1841
 TRYSON, GEORGE W., 1831-1833
 TUTWILER, C. C., 1920-
 TYLER, RUFUS, 1826-1837
 VAUCLAIN, SAMUEL M., 1898, 1906
 VAUX, GEORGE, JR., 1898-1899
 WALTER, JOSEPH S., JR., 1834-1837
 WALTER, THOMAS U., 1829-1831, 1840-1851
 WARDER, WILLIAM S., 1825-1827
 WARNER, JOHN S., 1837-1843
 WEAVER, JACOB, 1856-1857
 WEAVER, JOHN J., 1880-1891
 WEIGHTMAN, WILLIAM, 1862-1863
 WETHERILL, CHARLES, 1835
 WETHERILL, J. P., 1902
 WETHERILL, JOHN P., 1824-1825
 WETHERILL, WILLIAM, 1832
 WETHERILL, WILLIAM C., 1916-
 WEYGANDT, THOMAS J., 1851-1863
 WHARTON, WILLIAM, JR., 1871
 WHITAKER, GEORGE P., 1851-1852
 WHITE, CHARLES H., 1828-1835
 WHITE, SAMUEL S., 1864-1867
 WHITNEY, ASA, 1846-1850
 WHITNEY, GEORGE, 1858-1860
 WHITNEY, JAMES S., 1862-1863, 1865-1869
 WHITNEY, JOHN R., 1861
 WICKHAM, M. T., 1824
 WIEGAND, JOHN, 1831-1853
 WIEGAND, S. LLOYD, 1864, 1890-1893
 WILLIAMS, EDWARD H., 1871-1872
 WILLIAMS, ISAAC S., 1846-1850, 1852-1863
 WILSON, JOSEPH M., 1869-1886
 WILSON, O. HOWARD, 1864-1869
 WOLBORN, CORNELIUS A., 1844-1850
 WOLF, OTTO C., 1897-1913
 WOOD, ALAN, 1845-1863
 WOOD, SAMUEL R., 1824-1825
 WOOD, WALTER, 1903-1912
 WOOTTEN, JOHN E., 1860-1862
 YARDLEY, WILLIAM, JR., 1829
 YEAGER, JOSEPH, 1832
 YOUNG, ANDREW, 1828-1830

PAST CHAIRMEN OF THE COMMITTEE ON SCIENCE AND THE ARTS

1834-1922

| | |
|---|--|
| BACHE, ALEXANDER D., 1834-1836, 1839-1844 | KOENIG, G. A., 1888-1889 |
| BARNES, JAMES, 1922- | LEVY, LOUIS E., 1901-1902 |
| BEARDSLEY, ARTHUR, 1892-1895 | LEWIS, WILFRED, 1912-1913 |
| BILGRAM, HUGO, 1906-1907 | MARBURG, EDGAR, 1899-1900 |
| BONINE, CHARLES E., 1916-1917 | MARKS, W. D., 1881-1882, 1887-1888 |
| CHRISTIE, JAMES, 1897-1898 | MASLAND, CHARLES W. 1921-1922 |
| CLAMER, G. H., 1915-1916 | MCCONNELL, JACOB Y., 1909-1910 |
| CONARD, THOMAS P., 1902-1903 | ORR, HECTOR, 1880-1881 |
| CREIGHTON, H. JERMAIN, 1918-1919 | PATTERSON, R. M., 1836-1839 |
| CRESSON, J. C., 1844-1874 | PENROSE, CHARLES, 1920-1921 |
| CRISFIELD, J. A. P., 1913-1914 | ROGERS, JAMES S., 1908-1909 |
| ELDRIDGE, G. MORGAN, 1896-1897 | RONALDSON, CHARLES E., 1903-1904 |
| FRANKLIN, BENJAMIN, 1919-1920 | RONDINELLA, L. F., 1898-1899 |
| GOLDSMITH, EDWARD 1905-1906 | SARTAIN, SAMUEL, 1895-1896 |
| GRIGGS, WILLIAM O., 1907-1908 | SELLERS, COLEMAN, 1875-1880 |
| HAUPT, LEWIS M., 1904-1905 | SPANGLER, H. W., 1890-1891 |
| HENDERSON, GEORGE R., 1914-1915 | SPENCER, THOMAS, 1910-1911 |
| HEYL, HENRY R., 1882-1887, 1893- 1894, 1900-1901 | WETHERILL, WM. CHATTIN, 1917-1918 |
| HOADLEY, GEORGE A., 1911-1912 | WIEGAND S. LLOYD, 1889-1890, 1891- 1892 |

THE INSTITUTE'S ACTIVITIES

THE FRANKLIN INSTITUTE was organized in the year 1824 to meet a demand in America for an Institution similar to that founded by Count Rumford in London in 1799. The founders intended it not only as an appropriate memorial to the name of Franklin, but as a means of continuing for all time a work which throughout his long life he perhaps regarded as his best, namely, the discovery of physical and natural laws and their application to increase the well-being and comfort of mankind.

The Hall of the Institute is located on the east side of Seventh Street, between Market and Chestnut Streets, and was built from plans furnished by John Haviland, architect. The corner-stone was laid with appropriate Masonic and other ceremonies, on the eighth day of June, 1825, at noon. The funds for the purchase of the lot and the erection of the building were provided by the issue of a building loan, which was freely taken by members and friends of the enterprise, and has long since been repaid. The building was completed, and the Institute took possession of all except the second floor (which was occupied by the United States Courts until 1830) in 1826. Upon the first floor are located the lecture-room (capable of accommodating about 300), and laboratories and offices. The second floor is occupied by the library, to which special attention is paid elsewhere. The third floor is given up entirely to the use of the School of Mechanic Arts.

THE LIBRARY

The plan of the founders contemplated "the formation of a library of books relating to science and the useful arts, and the opening of a reading-room;" and, accordingly, in 1827, the first Committee on Library was appointed.

The books forming the nucleus of the library were stored in the residence of a member of the committee until early in the year 1829, when the first reading room was opened. During the next year a special committee of twenty issued an appeal for books and contributions of money in aid of the library.

The founding of the JOURNAL, in 1826, by opening the way to the establishment of exchange relations with other societies and with the leading magazines and periodicals devoted to science and the useful arts, proved an invaluable help in promoting its growth, and thus, early, gave to the library the distinctive character which it has since maintained. From the nucleus formed by this useful agency has grown a reference library of scientific literature, in some branches unique, and, in extent and completeness, second to none in the United States, embracing the publications of the principal scientific and technical societies of the world, and the leading periodicals devoted to science and the arts.

Several of the foreign governments have deposited with the library complete sets of their patent office publications. There are on the shelves for reference files of the specifications of the patent office of Great Britain since the year 1617, of France since 1791, of Switzerland since 1888, of the United States since 1790. Abstracts of the patents granted by Germany, Russia, Canada, Australia, Hungary and Austria can also be consulted.

The library is annually enriched, also, by the gift of numerous technical publications of a miscellaneous character from foreign governments, and from States and municipal authorities and corporations. These embrace publications relating to public works; official reports relating to geology, the mining and metallurgical industries, agriculture, public health, municipal engineering; reports of railway and other transportation companies, manufacturing corporations, etc.

For many years it has been the policy of this committee to increase the value of the collection as a library of reference, and to this end it has devoted systematic effort to the task of completing the files of its important serial publications. In this work, the committee, with the substantial assistance of several liberal contributions of money from generous friends of the Institute, has been notably successful.

At the present time the collection consists of 75,912 volumes and 18,254 pamphlets.

To inventors and manufacturers seeking for information respecting the state of the arts and manufactures, the extensive collection of patent literature which the library places at their disposal is indispensable, and the library is constantly resorted to by attorneys and their clients for the purpose of consulting these volumes; while, to the professional man and the student, the scientific and technical serials in which the library is so rich are no less indispensable as an aid in pursuing their investigations.

THE COMMITTEE ON SCIENCE AND THE ARTS

A branch of the Institute's work, which, perhaps, more obviously than any other, illustrates the spirit which animated the founders, and which their successors have worthily perpetuated and striven to improve and extend, is that which is now conducted by the Committee on Science and the Arts.

One of the things that was, apparently, uppermost in the thoughts of the founders, was the need—as urgent then as to-day—felt by inventors and discoverers, of some competent, trustworthy and impartial body, to whom they could safely appeal for advice, and on whose judgment they could confidently rely for an opinion, as to the usefulness of their inventions and discoveries.

One of the first acts of the Board of Managers was to appoint a Board of Examiners, whose duty it was to examine and make report upon all new and useful machines, inventions and discoveries submitted to them. Subsequently the name of the Board of Examiners was changed to the "Committee on Inventions."

YEAR BOOK OF

~~THE~~ ~~INSTITUTE~~ continued in existence until the year 1834, when, by ~~the~~ ~~act~~ ~~of~~ ~~the~~ ~~Legislature~~ it was abolished, and in its place there was established the "Committee on Science and the Arts," with enlarged powers and a ~~wide~~ ~~field~~ ~~of~~ ~~labor~~. As originally constituted, membership in this committee was open to all members of the Institute in good standing who chose to add their names, and who by thus voluntarily associating themselves with the committee, pledged themselves to perform the duties assigned to them.

Under this form of organization the committee continued for more than thirty years and its usefulness during this long period is attested by its reports containing the results of the examination of a great number of inventions, and of its investigations of many subjects of importance entrusted to it by the Institute.

In the year 1886, the Institute adopted an amendment to its by-laws, by which this committee was reorganized on an elective basis, thus abolishing the plan of voluntary association which had heretofore been a distinguishing feature. By this amendment the Institute established a Committee on Science and the Arts, to be composed of forty-five members of the Institute, to be chosen at the annual election (fifteen each year), and "who shall pledge themselves by their acceptance of membership to perform such duties as may devolve upon them, and to sustain by their labors the scientific character of the Institute."

Some years later the membership of the committee was increased from forty five to sixty and by a provision recently adopted the members are elected by the Board of Managers, twenty each year.

During the past twenty-five years the committee has investigated nearly 1000 discoveries, processes, and inventions.

THE JOURNAL

The publication of a journal for the diffusion of knowledge on all subjects connected with science and the useful arts, was embraced in the plan of the founders, and was undertaken shortly after the organization had been effected. This publication has been continued without interruption to the present time, and has proved most useful, not only in directly promoting the aims and objects of the Institute, but also in extending the sphere of its influence beyond the limits of its local habitation.

The first step to secure a publication was taken by the Institute as early as 1825, when, by arrangement with C. S. Williams, publisher, a magazine bearing the title *The American Mechanics' Magazine*, and which had been founded by him in New York at the beginning of that year, was acquired by Dr. Thomas P. Jones, who had recently been elected professor of mechanics in The Franklin Institute. At the outset the responsibility of this venture appears to have been assumed by Dr. Jones, after he had received assurances of active co-operation and support from the members of the Institute, who were warmly interested in its success.

The prospectus of the new publication, which was issued August 1, 1825, announced the fact that "shortly will be published

THE
FRANKLIN JOURNAL
AND
MECHANICS' MAGAZINE,

Under the Patronage
of the

FRANKLIN INSTITUTE, OF THE STATE OF PENNSYLVANIA, FOR THE PROMOTION OF THE
MECHANIC ARTS. EDITED BY DR. THOMAS P. JONES, PROFESSOR OF
MECHANICS IN THE INSTITUTE."

The object of *The Franklin Journal*, as defined in the prospectus, was, "to diffuse information on every subject connected with useful arts."

In the prospectus of *The Franklin Journal* attention is called to the fact that it was intended to give a list of patented inventions, with remarks upon their utility and originality. This proposition was literally maintained and continued as a prominent feature of the JOURNAL to the close of 1859, save that the "Remarks," which were in many cases of the greatest value to those interested in the progress of the arts and manufactures, were discontinued on the death of Dr. Jones. His accession to the position of Superintendent of the Patent Office naturally caused him to devote special attention to the preservation of the record of patents in the pages of the JOURNAL. This circumstance has since proved of considerable value to all who have need to refer to the early patents of the United States, as will appear from the following explanation:

In the official Patent Office publications, issued by the Government prior to the year 1843, the publication of the claims was omitted; while, for a considerable period, the JOURNAL published an abstract of the specifications and the claims in full. The JOURNAL, consequently, is the only source at present available for reference to the specifications and claims of patents issued by the United States, from 1828 to 1842, inclusive. The JOURNAL can also be used, in place of the official publications, as a source of reference to the patents granted during the period 1826-1859 in which the patent lists were published therein.

The complete file of the JOURNAL embraces *The Franklin Journal*, 1826-1827, and the JOURNAL OF THE FRANKLIN INSTITUTE, 1828 to the present time, 193 volumes in all, with a General Index, 1826 to 1885, and three decennial volumes covering the years 1886 to 1915, inclusive.

In its present form, the JOURNAL is an octavo of over 150 pages. It is published monthly, the twelve impressions being divided into two volumes yearly—January to June and July to December, each separately paged, and supplied with title-page and index.

THE SCHOOL OF MECHANIC ARTS

The first Board of Managers of the Institute provided for the establishment of a standing Committee on Instruction, charged with the duty of directing its educational work.

This committee was appointed on March 4, 1824 and speedily perfected plans for systematic instruction by means of lectures and demonstrations. Professorships in chemistry, in natural philosophy and mechanics, and in architecture were established and filled by the election of capable instructors.

Provision was next made for the instruction of mechanics and apprentices and those engaged in the useful trades, and early in the fall of 1824 a school of mechanical and architectural drawing was established. This experiment seems to have been crowned with complete success; and the managers proceeded to establish another school, in which should be taught "all the useful branches of English literature and the ancient and modern languages. This project was realized in 1826. In 1827 over three hundred scholars were upon its roll. It was the model upon which the Central High School, shortly afterwards established by the city as part of the public school system, was patterned. With the organization of the public high school, that of the Institute was abandoned as unnecessary. The drawing school, however, was continued, and has maintained an uninterrupted existence to the present. Its leading feature—that of training pupils for actual work in shop and office—has always been rigorously preserved, and at the present time, as a school for mechanical draughtsmen, it is conceded, by those best qualified to judge, to be one of the most thorough and practical of any in the country.

Twenty-three years ago classes in mathematics were established; these later became a part of the school of machine design. Instruction in naval architecture was first given in October, 1899.

All departments of instruction were united in the year 1910 and are now known as the School of Mechanic Arts.

LECTURES

These have always occupied a prominent place in the scheme of the Institute's work, from the beginning to the present.

The first course was given in the old Academy Building, on Fourth Street, near Arch, owned by the University of Pennsylvania, the use of which for this purpose was granted by the trustees; and the work of the professors was ably supplemented by a corps of volunteer lecturers from the membership of the Institute. A little later, the Institute rented the lower floor of the old Carpenters' Hall for this purpose, and finally, on the completion and occupancy of the hall, the lectures were held in its own lecture room.

For many years the lectures were of the nature of regular courses on architecture, mechanics, physics, and chemistry, varied of course from year to year, but following generally the plan of graded or consecutive instruction, as in schools and colleges. This system, however, though for a long period admirably useful in meeting the needs of the public, was found in time to be gradually outgrowing its usefulness. Lecture courses on scientific themes, which for years had been practically pre-empted by The Franklin Institute, in time were made attractive features in the schools and colleges, and the popular science lecturer became a conspicuous figure on the public lecture platform. And so it came about, naturally, that the Committee on Instruction

found it advantageous gradually to modify its plans to adapt them to the changes of the times. For a number of years, accordingly, the character of the Institute lectures has departed widely from the old-time pattern. The object at present most conspicuously kept in view in the selection of the lectures is to give the members of the Institute the advantage of having presented to them the latest advances in the useful arts and the sciences bearing thereon; and, to this end, the committee's efforts each year are directed to the purpose of securing the services of men of eminence in their respective fields of labor, who are invited to select their own themes. Since its foundation The Franklin Institute has given free to the public thousands of lectures by distinguished scientists and technologists on scientific and technological subjects in addition to numerous popular and illustrated addresses on subjects of immediate interest to the public and germane to the topics of the day.

MEETINGS

General meetings of the Institute's entire membership are held once each month, except during the summer. At these meetings great inventions and discoveries, important engineering projects, and notable achievements in all fields of scientific progress are presented, exhibited or discussed. Many of the epoch-making inventions have been shown in their experimental stages at these meetings—as the phonograph, the electric light, the typewriter, liquid air apparatus, machine telegraphy, etc.

EXHIBITIONS

As a means of promoting the mechanic arts, the holding of exhibitions was highly favored by the founders, and in this field of activity the Institute, for many years, was conspicuously prominent.

The first exhibition of American manufactures was held in October, 1824, in Carpenters' Hall.

This, it should be remembered to the credit of the Institute, was the first of the kind to be undertaken in this country.

The exhibitions of the Institute were held yearly or biennially, down to the year 1858. Many of the earlier events took place in the old Masonic Hall, on Chestnut Street, above Seventh, and in a temporary annex thereto; and the more recent ones in the one-time famous Museum Building, at Ninth and Sansom Streets, the destruction of which by fire, in the year 1850, made it necessary for the managers, for several years, to adapt themselves to less desirable quarters, and finally to discontinue the exhibitions for a time for want of a centrally located building suitable for the purpose.

In the year 1874 occurred the fiftieth anniversary of The Franklin Institute, and a fortunate circumstance enabled the managers to signalize the event by holding an exhibition, which proved from every point of view an eminently successful one. The circumstance spoken of was the fact that the Pennsylvania Railroad Company placed at the service of the Institute, for exhibition purposes, the old building at Thirteenth and Market Streets, for many years occupied as a freight station. Over 268,000 visitors attended this exhibition.

Successful, however, as was the exhibition of 1874, it was eclipsed in brilliancy, and in value from the educational and technical standpoint, by that of 1884, which will ever be memorable in the annals of The Franklin Institute. This was the Electrical Exhibition, held in the autumn of that year, under the direction of the Institute, and which by Act of Congress, approved February 26, 1883, was made international in character. It was the first exhibition in America devoted exclusively to the electrical arts.

In 1885 the Novelties Exhibition was held in the building erected for the electrical exhibition.

No further exhibitions have been held since that time, though the Institute co-operated with the Commercial Museum of Philadelphia in the management of the National Export Exposition of 1899.

SOME INSTANCES OF THE INSTITUTE'S WORK

(CHRONOLOGICALLY STATED)

1824. It held the first Exhibition of American Manufactures in Carpenters' Hall on October 18, 19, 20. Silver medals were awarded for steel, domestic carpetings, straw and grass bonnets, etc.

Classes were established in Chemistry, Mechanics, Natural History, Architecture, Mathematics, and Drawing.

The first course of lectures commenced April 28 and was held in the Academy Building, Fourth Street near Arch.

1826. In January the first number of *The Franklin Journal* was issued under the editorial management of Dr. Thomas P. Jones, who two years later became Superintendent of the United States Patent Office.

It extended its educational efforts by establishing on April 6th a High School, in which Mathematics, Drawing, Geography, History, Latin, Greek, French, Spanish and German were taught. Three hundred and four pupils were in attendance in October.

Thirty-four thousand visitors attended the Institute's Third Industrial Exhibition during its four days' progress.

1827. Select Committee on Dry Docks made a lengthy illustrated report, giving costs, methods of operation, etc.

1829. Committee appointed to investigate the efficiency of moving water as a motive power (water wheel experiments).

1830. Committee appointed to inquire into causes of the explosion of steam boilers.

1831. Joint Committee of The Franklin Institute and American Philosophical Society first began systematic meteorological observations in aid of agricultural and other interests.

1832. Commission appointed to examine into the resources, including agricultural, of Pennsylvania, an action which led to a Geological Survey of the State.

Notable paper in JOURNAL OF THE FRANKLIN INSTITUTE by Professor Walter R. Johnson on "The Strength of Steam Boilers."

The Secretary of the Treasury of the United States requested a further extension of the Institute's inquiry into the causes of the explosion of steam boilers to include the prevention of steam boiler explosions.

Committee appointed to investigate the strength of materials. This committee devised apparatus of various forms for the testing of metals, steam boilers, building materials, etc.

The Institute was requested by the State Legislature to examine and report upon the then existing system of weights and measures.

1834. The Secretary of the Commonwealth of Pennsylvania presented the thanks of the State for the report on weights and measures received from the Institute.

1837. The general interest created by the Institute's work gave rise to a movement for the establishment of a school of arts. The project failed at that time, but resulted later in the founding of the Department of Science of the University of Pennsylvania.

1838. The report of the Committee on Uniformity of Weights and Measures was printed. (The present laws of the State are based on this report.)

1839. November JOURNAL contained full translation of Daguerre's original communication to the French Academy describing his discoveries in photography (the Daguerreotype).

1840. Professor A. D. Bache's report on education in Europe appeared in the JOURNAL. (This report was made for use in connection with the organization of Girard College.)

1843. The Pennsylvania Legislature appropriated \$4000 to be devoted to the purchase of instruments for the equipment of stations throughout the State for the systematic observation and collection of meteorological facts; the expenditure being left in the hands of the Institute.

This is the earliest instance on record of the appropriation, in any country, of public funds for the collection of facts relating to the weather.

1850. The School of Design for Women was founded by the Institute, Mrs. Sarah Peters, first Directress.

1863. Monthly reports of Meteorological Phenomena at Philadelphia were published in the JOURNAL. (These were continued to 1869.)

1864. The shape and proportion of screw threads used in machine construction were investigated by a special committee. The report of this committee was presented in 1865 and recommended for adoption by machine builders throughout the United States a uniform and simplified system of screw threads.

A few years later this was officially adopted by the Government, and under the designation of the "U. S." or "Franklin Institute Standard" is now in universal use.

1869. Resolutions passed by the meeting in August and addressed to Congress suggested an exhibition to commemorate the hundredth anniversary of the United States and resulted in the holding of the Centennial Exhibition of 1876.

Solar Eclipse Expedition to Iowa in August, Dr. Henry Morton, Director. The services of the observers were gratuitous, the instruments were borrowed and the transportation for the party and equipment was furnished by the railroads.

1872. Committee on the mode of determining the horsepower of steam boilers published its report.

1873. The Institute approved Professor Lesley's recommendation of a more thorough Geological Survey of Pennsylvania, and asked the Legislature

to give prompt and full effect to the same. (The beginning of the Second Geological Survey.)

Committee on Conflagrations and Deaths from Petroleum Used in Lamps. A full report. Resolutions were sent to the Governor and Legislature, requesting the appointment of a commission to investigate the subject, determine tests, and to make laws relating to the burning of oils in lamps.

1874. Fiftieth anniversary. Held great industrial exhibition at Thirteenth and Market Streets—the site of the Wanamaker store.

1875. City Councils appropriated money for the expenses of an expert commission to be nominated by The Franklin Institute and to act in conjunction with the Chief Engineer of the Water Department. To this commission was referred the subject of the present and future water supply of Philadelphia.

1876. The Pennsylvania Museum and School of Industrial Art housed and fostered by the Institute.

1882. Report of the Special Committee on the pollution of the Schuylkill River presented its report suggesting the construction of an intercepting sewer along the Eastern banks of the Schuylkill from Manayunk, with an outlet below the densely populated portions of the city.

1883. Special Committee on the prevention of fires in theatres presented an exhaustive report which contained thirty-eight recommendations intended to make places of amusement more safe.

1884. Without Federal or State aid the Institute held the first great International Electrical Exhibition.

The first International Conference of Electricians was held during the progress of the exhibition.

During and immediately after the exhibition the most complete and extended series of tests attempted to that time were made to determine the characteristics of all the more important types of electrical apparatus and appliances then commercially used.

The organization of The American Institute of Electrical Engineers this year resulted from the holding of the Electrical Exhibition and the International Conference of Electricians held under the auspices of the Institute.

1885. Novelties exhibition held in the buildings erected for use of the electrical exhibition.

1887. The Institute organized the Pennsylvania State Weather Service. Voluntary observers made regular reports on the weather conditions of the State. An appropriation was made by the State to cover cost of clerical services and printing. The service was in operation until 1891, when the State discontinued the appropriation.

1890. Joseph M. Wilson's voluminous report on schools, with particular reference to trade schools, appeared in the JOURNAL OF THE FRANKLIN INSTITUTE during the year. (This report served as a basis for the organization of the Drexel Institute.)

1894. Germantown Junction branch of the drawing school established.

1897. A communication from the Board of Health of the City of Philadelphia requested the Institute to appoint a committee to confer with the Board of Health with a view of taking action to abate or modify the smoke nuisance. A full report appeared in the JOURNAL.

1899. National Export Exposition held in conjunction with the Commercial Museum of Philadelphia.

1901. Resolutions passed to promote commerce by the improvement of waterways and approving the creation of the Department of Commerce.

1902. The metric system fully discussed at the monthly meetings. Resolutions passed petitioning the national government to enact such laws as will ensure its proper use.

1906. Resolutions passed urging the improvement of national waterways, particularly the Chesapeake and Delaware Canal.

1914. Conducted meeting in Philadelphia celebrating thirtieth anniversary of the International Electrical Exhibition.

1915. First awards of The Franklin Medal.

1917. Established and maintained a recruiting and examination station for applicants for admission to the aviation service of the United States Army. Established School of Navigation for the United States Shipping Board. Conducted Free Radio School for men of the selective draft.

1920. Published "The Physics of the Air" by W. J. Humphreys, C.E., Ph.D.

under
now in u.

1869.

Congress su,
sary of the
Exhibition of n

Solar Eclipse

The services of the
and the transporta
the railroads.

1872. Committee o.
boilers published its repo.

1873. The Institute a
more thorough Geological S

CHARTER AND BY-LAWS

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS

An Act, to incorporate The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts.

SECTION 1. Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania in General Assembly met, and it is hereby enacted by the authority of the same, That the subscribers to the association called The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, and all such persons as may hereafter be admitted members of the same, shall be, and they are hereby declared to be, a body politic and corporate, by the name and style of "THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS," to have perpetual succession, to sue and be sued, implead and be impleaded, in all courts of record or elsewhere, to use a common seal, and break, alter, and renew the same at pleasure, and to take, hold, and enjoy lands, tenements, and hereditaments; Provided that the yearly income of the real estates held by them shall not exceed two thousand dollars.

SEC. 2. And be it further enacted by the authority aforesaid, That the objects of the said corporation shall be the promotion and encouragement of manufactures and the mechanic and useful arts, by the establishment of popular lectures on the sciences connected with them, by the formation of a cabinet of models and minerals, and a library, by offering premiums on all objects deemed worthy of encouragement, by examining all new inventions submitted to them, and by such other measures as they may judge expedient.

SEC. 3. And be it further enacted by the authority aforesaid, That the members of the said corporation shall consist of manufacturers, mechanics, artisans, and persons friendly to the mechanic arts; they shall pay such sum annually, or in gross, as shall be required by the by-laws of the said corporation for an annual, or life, subscription; Provided that nothing herein contained shall be construed to prevent the said corporation from electing honorary or corresponding members, who may be exempted from such payments and other duties of membership, in such manner and to such extent as may be prescribed by the by-laws of the said corporation.

SEC. 4. And be it further enacted by the authority aforesaid, That the officers of the said corporation shall be a president, two vice-presidents, a recording secretary, a corresponding secretary, a treasurer, and twenty-four managers, who shall, together, constitute a board of managers of the said corporation, and such other officers as the said corporation shall deem needful; two-thirds of the managers shall be manufacturers or mechanics; the

THE INSTITUTE'S ACTIVITIES

THE FRANKLIN INSTITUTE was organized in the year 1824 to meet a demand in America for an Institution similar to that founded by Count Rumford in London in 1799. The founders intended it not only as an appropriate memorial to the name of Franklin, but as a means of continuing for all time a work which throughout his long life he perhaps regarded as his best, namely, the discovery of physical and natural laws and their application to increase the well-being and comfort of mankind.

The Hall of the Institute is located on the east side of Seventh Street, between Market and Chestnut Streets, and was built from plans furnished by John Haviland, architect. The corner-stone was laid with appropriate Masonic and other ceremonies, on the eighth day of June, 1825, at noon. The funds for the purchase of the lot and the erection of the building were provided by the issue of a building loan, which was freely taken by members and friends of the enterprise, and has long since been repaid. The building was completed, and the Institute took possession of all except the second floor (which was occupied by the United States Courts until 1830) in 1826. Upon the first floor are located the lecture-room (capable of accommodating about 300), and laboratories and offices. The second floor is occupied by the library, to which special attention is paid elsewhere. The third floor is given up entirely to the use of the School of Mechanic Arts.

THE LIBRARY

The plan of the founders contemplated "the formation of a library of books relating to science and the useful arts, and the opening of a reading-room;" and, accordingly, in 1827, the first Committee on Library was appointed.

The books forming the nucleus of the library were stored in the residence of a member of the committee until early in the year 1829, when the first reading room was opened. During the next year a special committee of twenty issued an appeal for books and contributions of money in aid of the library.

The founding of the JOURNAL, in 1826, by opening the way to the establishment of exchange relations with other societies and with the leading magazines and periodicals devoted to science and the useful arts, proved an invaluable help in promoting its growth, and thus, early, gave to the library the distinctive character which it has since maintained. From the nucleus formed by this useful agency has grown a reference library of scientific literature, in some branches unique, and, in extent and completeness, second to none in the United States, embracing the publications of the principal scientific and technical societies of the world, and the leading periodicals devoted to science and the arts.

Several of the foreign governments have deposited with the library complete sets of their patent office publications. There are on the shelves for reference files of the specifications of the patent office of Great Britain since the year 1617, of France since 1791, of Switzerland since 1888, of the United States since 1790. Abstracts of the patents granted by Germany, Russia, Canada, Australia, Hungary and Austria can also be consulted.

The library is annually enriched, also, by the gift of numerous technical publications of a miscellaneous character from foreign governments, and from States and municipal authorities and corporations. These embrace publications relating to public works; official reports relating to geology, the mining and metallurgical industries, agriculture, public health, municipal engineering; reports of railway and other transportation companies, manufacturing corporations, etc.

For many years it has been the policy of this committee to increase the value of the collection as a library of reference, and to this end it has devoted systematic effort to the task of completing the files of its important serial publications. In this work, the committee, with the substantial assistance of several liberal contributions of money from generous friends of the Institute, has been notably successful.

At the present time the collection consists of 75,912 volumes and 18,254 pamphlets.

To inventors and manufacturers seeking for information respecting the state of the arts and manufactures, the extensive collection of patent literature which the library places at their disposal is indispensable, and the library is constantly resorted to by attorneys and their clients for the purpose of consulting these volumes; while, to the professional man and the student, the scientific and technical serials in which the library is so rich are no less indispensable as an aid in pursuing their investigations.

THE COMMITTEE ON SCIENCE AND THE ARTS

A branch of the Institute's work, which, perhaps, more obviously than any other, illustrates the spirit which animated the founders, and which their successors have worthily perpetuated and striven to improve and extend, is that which is now conducted by the Committee on Science and the Arts.

One of the things that was, apparently, uppermost in the thoughts of the founders, was the need—as urgent then as to-day—felt by inventors and discoverers, of some competent, trustworthy and impartial body, to whom they could safely appeal for advice, and on whose judgment they could confidently rely for an opinion, as to the usefulness of their inventions and discoveries.

One of the first acts of the Board of Managers was to appoint a Board of Examiners, whose duty it was to examine and make report upon all new and useful machines, inventions and discoveries submitted to them. Subsequently the name of the Board of Examiners was changed to the "Committee on Inventions."

This organization continued in existence until the year 1834, when, by act of the Institute, it was abolished, and in its place there was established the "Committee on Science and the Arts," with enlarged powers and a wider field of labor. As originally constituted, membership in this committee was open to all members of the Institute in good standing who chose to enroll their names, and who by thus voluntarily associating themselves with the committee, pledged themselves to perform the duties assigned to them.

Under this form of organization the committee continued for more than fifty years, and its usefulness during this long period is attested by its records, containing the results of the examination of a great number of inventions, and of its investigations of many subjects of importance entrusted to it by the Institute.

In the year 1886, the Institute adopted an amendment to its by-laws, by which this committee was reorganized on an elective basis, thus abolishing the plan of voluntary association which had heretofore been a distinguishing feature. By this amendment the Institute established a Committee on Science and the Arts, to be composed of forty-five members of the Institute, to be chosen at the annual election (fifteen each year), and "who shall pledge themselves by their acceptance of membership to perform such duties as may devolve upon them, and to sustain by their labors the scientific character of the Institute."

Some years later the membership of the committee was increased from forty-five to sixty and by a provision recently adopted the members are elected by the Board of Managers, twenty each year.

During the past twenty-five years the committee has investigated nearly 1000 discoveries, processes, and inventions.

THE JOURNAL

The publication of a journal for the diffusion of knowledge on all subjects connected with science and the useful arts, was embraced in the plan of the founders, and was undertaken shortly after the organization had been effected. This publication has been continued without interruption to the present time, and has proved most useful, not only in directly promoting the aims and objects of the Institute, but also in extending the sphere of its influence beyond the limits of its local habitation.

The first step to secure a publication was taken by the Institute as early as 1825, when, by arrangement with C. S. Williams, publisher, a magazine bearing the title *The American Mechanics' Magazine*, and which had been founded by him in New York at the beginning of that year, was acquired by Dr. Thomas P. Jones, who had recently been elected professor of mechanics in The Franklin Institute. At the outset the responsibility of this venture appears to have been assumed by Dr. Jones, after he had received assurances of active co-operation and support from the members of the Institute, who were warmly interested in its success.

The prospectus of the new publication, which was issued August 1, 1825, announced the fact that "shortly will be published

THE
FRANKLIN JOURNAL
AND
MECHANICS' MAGAZINE,

Under the Patronage
of the

FRANKLIN INSTITUTE, OF THE STATE OF PENNSYLVANIA, FOR THE PROMOTION OF THE
MECHANIC ARTS. EDITED BY DR. THOMAS P. JONES, PROFESSOR OF
MECHANICS IN THE INSTITUTE."

The object of *The Franklin Journal*, as defined in the prospectus, was, "to diffuse information on every subject connected with useful arts."

In the prospectus of *The Franklin Journal* attention is called to the fact that it was intended to give a list of patented inventions, with remarks upon their utility and originality. This proposition was literally maintained and continued as a prominent feature of the JOURNAL to the close of 1859, save that the "Remarks," which were in many cases of the greatest value to those interested in the progress of the arts and manufactures, were discontinued on the death of Dr. Jones. His accession to the position of Superintendent of the Patent Office naturally caused him to devote special attention to the preservation of the record of patents in the pages of the JOURNAL. This circumstance has since proved of considerable value to all who have need to refer to the early patents of the United States, as will appear from the following explanation:

In the official Patent Office publications, issued by the Government prior to the year 1843, the publication of the claims was omitted; while, for a considerable period, the JOURNAL published an abstract of the specifications and the claims in full. The JOURNAL, consequently, is the only source at present available for reference to the specifications and claims of patents issued by the United States, from 1828 to 1842, inclusive. The JOURNAL can also be used, in place of the official publications, as a source of reference to the patents granted during the period 1826-1859 in which the patent lists were published therein.

The complete file of the JOURNAL embraces *The Franklin Journal*, 1826-1827, and the JOURNAL OF THE FRANKLIN INSTITUTE, 1828 to the present time, 193 volumes in all, with a General Index, 1826 to 1885, and three decennial volumes covering the years 1886 to 1915, inclusive.

In its present form, the JOURNAL is an octavo of over 150 pages. It is published monthly, the twelve impressions being divided into two volumes yearly—January to June and July to December, each separately paged, and supplied with title-page and index.

THE SCHOOL OF MECHANIC ARTS

The first Board of Managers of the Institute provided for the establishment of a standing Committee on Instruction, charged with the duty of directing its educational work.

This committee was appointed on March 4, 1824 and speedily perfected plans for systematic instruction by means of lectures and demonstrations. Professorships in chemistry, in natural philosophy and mechanics, and in architecture were established and filled by the election of capable instructors.

Provision was next made for the instruction of mechanics and apprentices and those engaged in the useful trades, and early in the fall of 1824 a school of mechanical and architectural drawing was established. This experiment seems to have been crowned with complete success; and the managers proceeded to establish another school, in which should be taught "all the useful branches of English literature and the ancient and modern languages. This project was realized in 1826. In 1827 over three hundred scholars were upon its roll. It was the model upon which the Central High School, shortly afterwards established by the city as part of the public school system, was patterned. With the organization of the public high school, that of the Institute was abandoned as unnecessary. The drawing school, however, was continued, and has maintained an uninterrupted existence to the present. Its leading feature—that of training pupils for actual work in shop and office—has always been rigorously preserved, and at the present time, as a school for mechanical draughtsmen, it is conceded, by those best qualified to judge, to be one of the most thorough and practical of any in the country.

Twenty-three years ago classes in mathematics were established; these later became a part of the school of machine design. Instruction in naval architecture was first given in October, 1899.

All departments of instruction were united in the year 1910 and are now known as the School of Mechanic Arts.

LECTURES

These have always occupied a prominent place in the scheme of the Institute's work, from the beginning to the present.

The first course was given in the old Academy Building, on Fourth Street, near Arch, owned by the University of Pennsylvania, the use of which for this purpose was granted by the trustees; and the work of the professors was ably supplemented by a corps of volunteer lecturers from the membership of the Institute. A little later, the Institute rented the lower floor of the old Carpenters' Hall for this purpose, and finally, on the completion and occupancy of the hall, the lectures were held in its own lecture room.

For many years the lectures were of the nature of regular courses on architecture, mechanics, physics, and chemistry, varied of course from year to year, but following generally the plan of graded or consecutive instruction, as in schools and colleges. This system, however, though for a long period admirably useful in meeting the needs of the public, was found in time to be gradually outgrowing its usefulness. Lecture courses on scientific themes, which for years had been practically pre-empted by The Franklin Institute, in time were made attractive features in the schools and colleges, and the popular science lecturer became a conspicuous figure on the public lecture platform. And so it came about, naturally, that the Committee on Instruction

found it advantageous gradually to modify its plans to adapt them to the changes of the times. For a number of years, accordingly, the character of the Institute lectures has departed widely from the old-time pattern. The object at present most conspicuously kept in view in the selection of the lectures is to give the members of the Institute the advantage of having presented to them the latest advances in the useful arts and the sciences bearing thereon; and, to this end, the committee's efforts each year are directed to the purpose of securing the services of men of eminence in their respective fields of labor, who are invited to select their own themes. Since its foundation The Franklin Institute has given free to the public thousands of lectures by distinguished scientists and technologists on scientific and technological subjects in addition to numerous popular and illustrated addresses on subjects of immediate interest to the public and germane to the topics of the day.

MEETINGS

General meetings of the Institute's entire membership are held once each month, except during the summer. At these meetings great inventions and discoveries, important engineering projects, and notable achievements in all fields of scientific progress are presented, exhibited or discussed. Many of the epoch-making inventions have been shown in their experimental stages at these meetings—as the phonograph, the electric light, the typewriter, liquid air apparatus, machine telegraphy, etc.

EXHIBITIONS

As a means of promoting the mechanic arts, the holding of exhibitions was highly favored by the founders, and in this field of activity the Institute, for many years, was conspicuously prominent.

The first exhibition of American manufactures was held in October, 1824, in Carpenters' Hall.

This, it should be remembered to the credit of the Institute, was the first of the kind to be undertaken in this country.

The exhibitions of the Institute were held yearly or biennially, down to the year 1858. Many of the earlier events took place in the old Masonic Hall, on Chestnut Street, above Seventh, and in a temporary annex thereto; and the more recent ones in the one-time famous Museum Building, at Ninth and Sansom Streets, the destruction of which by fire, in the year 1850, made it necessary for the managers, for several years, to adapt themselves to less desirable quarters, and finally to discontinue the exhibitions for a time for want of a centrally located building suitable for the purpose.

In the year 1874 occurred the fiftieth anniversary of The Franklin Institute, and a fortunate circumstance enabled the managers to signalize the event by holding an exhibition, which proved from every point of view an eminently successful one. The circumstance spoken of was the fact that the Pennsylvania Railroad Company placed at the service of the Institute, for exhibition purposes, the old building at Thirteenth and Market Streets, for many years occupied as a freight station. Over 268,000 visitors attended this exhibition.

Successful, however, as was the exhibition of 1874, it was eclipsed in brilliancy, and in value from the educational and technical standpoint, by that of 1884, which will ever be memorable in the annals of The Franklin Institute. This was the Electrical Exhibition, held in the autumn of that year, under the direction of the Institute, and which by Act of Congress, approved February 26, 1883, was made international in character. It was the first exhibition in America devoted exclusively to the electrical arts.

In 1885 the Novelties Exhibition was held in the building erected for the electrical exhibition.

No further exhibitions have been held since that time, though the Institute co-operated with the Commercial Museum of Philadelphia in the management of the National Export Exposition of 1899.

SOME INSTANCES OF THE INSTITUTE'S WORK

(CHRONOLOGICALLY STATED)

1824. It held the first Exhibition of American Manufactures in Carpenters' Hall on October 18, 19, 20. Silver medals were awarded for steel, domestic carpetings, straw and grass bonnets, etc.

Classes were established in Chemistry, Mechanics, Natural History, Architecture, Mathematics, and Drawing.

The first course of lectures commenced April 28 and was held in the Academy Building, Fourth Street near Arch.

1826. In January the first number of *The Franklin Journal* was issued under the editorial management of Dr. Thomas P. Jones, who two years later became Superintendent of the United States Patent Office.

It extended its educational efforts by establishing on April 6th a High School, in which Mathematics, Drawing, Geography, History, Latin, Greek, French, Spanish and German were taught. Three hundred and four pupils were in attendance in October.

Thirty-four thousand visitors attended the Institute's Third Industrial Exhibition during its four days' progress.

1827. Select Committee on Dry Docks made a lengthy illustrated report, giving costs, methods of operation, etc.

1829. Committee appointed to investigate the efficiency of moving water as a motive power (water wheel experiments).

1830. Committee appointed to inquire into causes of the explosion of steam boilers.

1831. Joint Committee of The Franklin Institute and American Philosophical Society first began systematic meteorological observations in aid of agricultural and other interests.

1832. Commission appointed to examine into the resources, including agricultural, of Pennsylvania, an action which led to a Geological Survey of the State.

Notable paper in JOURNAL OF THE FRANKLIN INSTITUTE by Professor Walter R. Johnson on "The Strength of Steam Boilers."

The Secretary of the Treasury of the United States requested a further extension of the Institute's inquiry into the causes of the explosion of steam boilers to include the prevention of steam boiler explosions.

Committee appointed to investigate the strength of materials. This committee devised apparatus of various forms for the testing of metals, steam boilers, building materials, etc.

The Institute was requested by the State Legislature to examine and report upon the then existing system of weights and measures.

1834. The Secretary of the Commonwealth of Pennsylvania presented the thanks of the State for the report on weights and measures received from the Institute.

1837. The general interest created by the Institute's work gave rise to a movement for the establishment of a school of arts. The project failed at that time, but resulted later in the founding of the Department of Science of the University of Pennsylvania.

1838. The report of the Committee on Uniformity of Weights and Measures was printed. (The present laws of the State are based on this report.)

1839. November JOURNAL contained full translation of Daguerre's original communication to the French Academy describing his discoveries in photography (the Daguerreotype).

1840. Professor A. D. Bache's report on education in Europe appeared in the JOURNAL. (This report was made for use in connection with the organization of Girard College.)

1843. The Pennsylvania Legislature appropriated \$4000 to be devoted to the purchase of instruments for the equipment of stations throughout the State for the systematic observation and collection of meteorological facts; the expenditure being left in the hands of the Institute.

This is the earliest instance on record of the appropriation, in any country, of public funds for the collection of facts relating to the weather.

1850. The School of Design for Women was founded by the Institute, Mrs. Sarah Peters, first Directress.

1863. Monthly reports of Meteorological Phenomena at Philadelphia were published in the JOURNAL. (These were continued to 1869.)

1864. The shape and proportion of screw threads used in machine construction were investigated by a special committee. The report of this committee was presented in 1865 and recommended for adoption by machine builders throughout the United States a uniform and simplified system of screw threads.

A few years later this was officially adopted by the Government, and under the designation of the "U. S." or "Franklin Institute Standard" is now in universal use.

1869. Resolutions passed by the meeting in August and addressed to Congress suggested an exhibition to commemorate the hundredth anniversary of the United States and resulted in the holding of the Centennial Exhibition of 1876.

Solar Eclipse Expedition to Iowa in August, Dr. Henry Morton, Director. The services of the observers were gratuitous, the instruments were borrowed and the transportation for the party and equipment was furnished by the railroads.

1872. Committee on the mode of determining the horsepower of steam boilers published its report.

1873. The Institute approved Professor Lesley's recommendation of a more thorough Geological Survey of Pennsylvania, and asked the Legislature

to give prompt and full effect to the same. (The beginning of the Second Geological Survey.)

Committee on Conflagrations and Deaths from Petroleum Used in Lamps. A full report. Resolutions were sent to the Governor and Legislature, requesting the appointment of a commission to investigate the subject, determine tests, and to make laws relating to the burning of oils in lamps.

1874. Fiftieth anniversary. Held great industrial exhibition at Thirteenth and Market Streets—the site of the Wanamaker store.

1875. City Councils appropriated money for the expenses of an expert commission to be nominated by The Franklin Institute and to act in conjunction with the Chief Engineer of the Water Department. To this commission was referred the subject of the present and future water supply of Philadelphia.

1876. The Pennsylvania Museum and School of Industrial Art housed and fostered by the Institute.

1882. Report of the Special Committee on the pollution of the Schuylkill River presented its report suggesting the construction of an intercepting sewer along the Eastern banks of the Schuylkill from Manayunk, with an outlet below the densely populated portions of the city.

1883. Special Committee on the prevention of fires in theatres presented an exhaustive report which contained thirty-eight recommendations intended to make places of amusement more safe.

1884. Without Federal or State aid the Institute held the first great International Electrical Exhibition.

The first International Conference of Electricians was held during the progress of the exhibition.

During and immediately after the exhibition the most complete and extended series of tests attempted to that time were made to determine the characteristics of all the more important types of electrical apparatus and appliances then commercially used.

The organization of The American Institute of Electrical Engineers this year resulted from the holding of the Electrical Exhibition and the International Conference of Electricians held under the auspices of the Institute.

1885. Novelties exhibition held in the buildings erected for use of the electrical exhibition.

1887. The Institute organized the Pennsylvania State Weather Service. Voluntary observers made regular reports on the weather conditions of the State. An appropriation was made by the State to cover cost of clerical services and printing. The service was in operation until 1891, when the State discontinued the appropriation.

1890. Joseph M. Wilson's voluminous report on schools, with particular reference to trade schools, appeared in the JOURNAL OF THE FRANKLIN INSTITUTE during the year. (This report served as a basis for the organization of the Drexel Institute.)

1894. Germantown Junction branch of the drawing school established.

1834. The Secretary of the Commonwealth of Pennsylvania presented the thanks of the State for the report on weights and measures received from the Institute.

1837. The general interest created by the Institute's work gave rise to a movement for the establishment of a school of arts. The project failed at that time, but resulted later in the founding of the Department of Science of the University of Pennsylvania.

1838. The report of the Committee on Uniformity of Weights and Measures was printed. (The present laws of the State are based on this report.)

1839. November JOURNAL contained full translation of Daguerre's original communication to the French Academy describing his discoveries in photography (the Daguerreotype).

1840. Professor A. D. Bache's report on education in Europe appeared in the JOURNAL. (This report was made for use in connection with the organization of Girard College.)

1843. The Pennsylvania Legislature appropriated \$4000 to be devoted to the purchase of instruments for the equipment of stations throughout the State for the systematic observation and collection of meteorological facts; the expenditure being left in the hands of the Institute.

This is the earliest instance on record of the appropriation, in any country, of public funds for the collection of facts relating to the weather.

1850. The School of Design for Women was founded by the Institute, Mrs. Sarah Peters, first Directress.

1863. Monthly reports of Meteorological Phenomena at Philadelphia were published in the JOURNAL. (These were continued to 1869.)

1864. The shape and proportion of screw threads used in machine construction were investigated by a special committee. The report of this committee was presented in 1865 and recommended for adoption by machine builders throughout the United States a uniform and simplified system of screw threads.

A few years later this was officially adopted by the Government, and under the designation of the "U. S." or "Franklin Institute Standard" is now in universal use.

1869. Resolutions passed by the meeting in August and addressed to Congress suggested an exhibition to commemorate the hundredth anniversary of the United States and resulted in the holding of the Centennial Exhibition of 1876.

Solar Eclipse Expedition to Iowa in August, Dr. Henry Morton, Director. The services of the observers were gratuitous, the instruments were borrowed and the transportation for the party and equipment was furnished by the railroads.

1872. Committee on the mode of determining the horsepower of steam boilers published its report.

1873. The Institute approved Professor Lesley's recommendation of a more thorough Geological Survey of Pennsylvania, and asked the Legislature

to give prompt and full effect to the same. (The beginning of the Second Geological Survey.)

Committee on Conflagrations and Deaths from Petroleum Used in Lamps. A full report. Resolutions were sent to the Governor and Legislature, requesting the appointment of a commission to investigate the subject, determine tests, and to make laws relating to the burning of oils in lamps.

1874. Fiftieth anniversary. Held great industrial exhibition at Thirteenth and Market Streets—the site of the Wanamaker store.

1875. City Councils appropriated money for the expenses of an expert commission to be nominated by The Franklin Institute and to act in conjunction with the Chief Engineer of the Water Department. To this commission was referred the subject of the present and future water supply of Philadelphia.

1876. The Pennsylvania Museum and School of Industrial Art housed and fostered by the Institute.

1882. Report of the Special Committee on the pollution of the Schuylkill River presented its report suggesting the construction of an intercepting sewer along the Eastern banks of the Schuylkill from Manayunk, with an outlet below the densely populated portions of the city.

1883. Special Committee on the prevention of fires in theatres presented an exhaustive report which contained thirty-eight recommendations intended to make places of amusement more safe.

1884. Without Federal or State aid the Institute held the first great International Electrical Exhibition.

The first International Conference of Electricians was held during the progress of the exhibition.

During and immediately after the exhibition the most complete and extended series of tests attempted to that time were made to determine the characteristics of all the more important types of electrical apparatus and appliances then commercially used.

The organization of The American Institute of Electrical Engineers this year resulted from the holding of the Electrical Exhibition and the International Conference of Electricians held under the auspices of the Institute.

1885. Novelties exhibition held in the buildings erected for use of the electrical exhibition.

1887. The Institute organized the Pennsylvania State Weather Service. Voluntary observers made regular reports on the weather conditions of the State. An appropriation was made by the State to cover cost of clerical services and printing. The service was in operation until 1891, when the State discontinued the appropriation.

1890. Joseph M. Wilson's voluminous report on schools, with particular reference to trade schools, appeared in the JOURNAL OF THE FRANKLIN INSTITUTE during the year. (This report served as a basis for the organization of the Drexel Institute.)

1894. Germantown Junction branch of the drawing school established.

1834. The Secretary of the Commonwealth of Pennsylvania presented the thanks of the State for the report on weights and measures received from the Institute.

1837. The general interest created by the Institute's work gave rise to a movement for the establishment of a school of arts. The project failed at that time, but resulted later in the founding of the Department of Science of the University of Pennsylvania.

1838. The report of the Committee on Uniformity of Weights and Measures was printed. (The present laws of the State are based on this report.)

1839. November JOURNAL contained full translation of Daguerre's original communication to the French Academy describing his discoveries in photography (the Daguerreotype).

1840. Professor A. D. Bache's report on education in Europe appeared in the JOURNAL. (This report was made for use in connection with the organization of Girard College.)

1843. The Pennsylvania Legislature appropriated \$4000 to be devoted to the purchase of instruments for the equipment of stations throughout the State for the systematic observation and collection of meteorological facts; the expenditure being left in the hands of the Institute.

This is the earliest instance on record of the appropriation, in any country, of public funds for the collection of facts relating to the weather.

1850. The School of Design for Women was founded by the Institute, Mrs. Sarah Peters, first Directress.

1863. Monthly reports of Meteorological Phenomena at Philadelphia were published in the JOURNAL. (These were continued to 1869.)

1864. The shape and proportion of screw threads used in machine construction were investigated by a special committee. The report of this committee was presented in 1865 and recommended for adoption by machine builders throughout the United States a uniform and simplified system of screw threads.

A few years later this was officially adopted by the Government, and under the designation of the "U. S." or "Franklin Institute Standard" is now in universal use.

1869. Resolutions passed by the meeting in August and addressed to Congress suggested an exhibition to commemorate the hundredth anniversary of the United States and resulted in the holding of the Centennial Exhibition of 1876.

Solar Eclipse Expedition to Iowa in August, Dr. Henry Morton, Director. The services of the observers were gratuitous, the instruments were borrowed and the transportation for the party and equipment was furnished by the railroads.

1872. Committee on the mode of determining the horsepower of steam boilers published its report.

1873. The Institute approved Professor Lesley's recommendation of a more thorough Geological Survey of Pennsylvania, and asked the Legislature

to give prompt and full effect to the same. (The beginning of the Second Geological Survey.)

Committee on Conflagrations and Deaths from Petroleum Used in Lamps. A full report. Resolutions were sent to the Governor and Legislature, requesting the appointment of a commission to investigate the subject, determine tests, and to make laws relating to the burning of oils in lamps.

1874. Fiftieth anniversary. Held great industrial exhibition at Thirteenth and Market Streets—the site of the Wanamaker store.

1875. City Councils appropriated money for the expenses of an expert commission to be nominated by The Franklin Institute and to act in conjunction with the Chief Engineer of the Water Department. To this commission was referred the subject of the present and future water supply of Philadelphia.

1876. The Pennsylvania Museum and School of Industrial Art housed and fostered by the Institute.

1882. Report of the Special Committee on the pollution of the Schuylkill River presented its report suggesting the construction of an intercepting sewer along the Eastern banks of the Schuylkill from Manayunk, with an outlet below the densely populated portions of the city.

1883. Special Committee on the prevention of fires in theatres presented an exhaustive report which contained thirty-eight recommendations intended to make places of amusement more safe.

1884. Without Federal or State aid the Institute held the first great International Electrical Exhibition.

The first International Conference of Electricians was held during the progress of the exhibition.

During and immediately after the exhibition the most complete and extended series of tests attempted to that time were made to determine the characteristics of all the more important types of electrical apparatus and appliances then commercially used.

The organization of The American Institute of Electrical Engineers this year resulted from the holding of the Electrical Exhibition at the International Conference of Electricians held under the auspices of the Institute.

1885. Novelties exhibition held in the buildings erected for use of the electrical exhibition.

1887. The Institute organized the Pennsylvania State Weather Service. Voluntary observers made regular reports on the weather conditions of the State. An appropriation was made by the State to cover cost of clerical services and printing. The service was in operation until 1891, when the State discontinued the appropriation.

1890. Joseph M. Wilson's voluminous report on schools, with particular reference to trade schools, appeared in the JOURNAL OF THE FRANKLIN INSTITUTE during the year. (This report served as a basis for the organization of the Drexel Institute.)

1894. Germantown Junction branch of the drawing school established.

1897. A communication from the Board of Health of the City of Philadelphia requested the Institute to appoint a committee to confer with the Board of Health with a view of taking action to abate or modify the smoke nuisance. A full report appeared in the JOURNAL.

1899. National Export Exposition held in conjunction with the Commercial Museum of Philadelphia.

1901. Resolutions passed to promote commerce by the improvement of waterways and approving the creation of the Department of Commerce.

1902. The metric system fully discussed at the monthly meetings. Resolutions passed petitioning the national government to enact such laws as will ensure its proper use.

1906. Resolutions passed urging the improvement of national waterways, particularly the Chesapeake and Delaware Canal.

1914. Conducted meeting in Philadelphia celebrating thirtieth anniversary of the International Electrical Exhibition.

1915. First awards of The Franklin Medal.

1917. Established and maintained a recruiting and examination station for applicants for admission to the aviation service of the United States Army. Established School of Navigation for the United States Shipping Board. Conducted Free Radio School for men of the selective draft.

1920. Published "The Physics of the Air" by W. J. Humphreys, C.E., Ph.D.

CHARTER AND BY-LAWS

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS

An Act, to incorporate The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts.

SECTION 1. Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania in General Assembly met, and it is hereby enacted by the authority of the same, That the subscribers to the association called The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, and all such persons as may hereafter be admitted members of the same, shall be, and they are hereby declared to be, a body politic and corporate, by the name and style of "THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS," to have perpetual succession, to sue and be sued, implead and be impleaded, in all courts of record or elsewhere, to use a common seal, and break, alter, and renew the same at pleasure, and to take, hold, and enjoy lands, tenements, and hereditaments; Provided that the yearly income of the real estates held by them shall not exceed two thousand dollars.

SEC. 2. And be it further enacted by the authority aforesaid, That the objects of the said corporation shall be the promotion and encouragement of manufactures and the mechanic and useful arts, by the establishment of popular lectures on the sciences connected with them, by the formation of a cabinet of models and minerals, and a library, by offering premiums on all objects deemed worthy of encouragement, by examining all new inventions submitted to them, and by such other measures as they may judge expedient.

SEC. 3. And be it further enacted by the authority aforesaid, That the members of the said corporation shall consist of manufacturers, mechanics, artisans, and persons friendly to the mechanic arts; they shall pay such sum annually, or in gross, as shall be required by the by-laws of the said corporation for an annual, or life, subscription; Provided that nothing herein contained shall be construed to prevent the said corporation from electing honorary or corresponding members, who may be exempted from such payments and other duties of membership, in such manner and to such extent as may be prescribed by the by-laws of the said corporation.

SEC. 4. And be it further enacted by the authority aforesaid, That the officers of the said corporation shall be a president, two vice-presidents, a recording secretary, a corresponding secretary, a treasurer, and twenty-four managers, who shall, together, constitute a board of managers of the said corporation, and such other officers as the said corporation shall deem needful; two-thirds of the managers shall be manufacturers or mechanics; the

1897. A communication from the Board of Health of the City of Philadelphia requested the Institute to appoint a committee to confer with the Board of Health with a view of taking action to abate or modify the smoke nuisance. A full report appeared in the JOURNAL.

1899. National Export Exposition held in conjunction with the Commercial Museum of Philadelphia.

1901. Resolutions passed to promote commerce by the improvement of waterways and approving the creation of the Department of Commerce.

1902. The metric system fully discussed at the monthly meetings. Resolutions passed petitioning the national government to enact such laws as will ensure its proper use.

1906. Resolutions passed urging the improvement of national waterways, particularly the Chesapeake and Delaware Canal.

1914. Conducted meeting in Philadelphia celebrating thirtieth anniversary of the International Electrical Exhibition.

1915. First awards of The Franklin Medal.

1917. Established and maintained a recruiting and examination station for applicants for admission to the aviation service of the United States Army. Established School of Navigation for the United States Shipping Board. Conducted Free Radio School for men of the selective draft.

1920. Published "The Physics of the Air" by W. J. Humphreys, C.E., Ph.D.

CHARTER AND BY-LAWS

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS

An Act, to incorporate The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts.

SECTION 1. Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania in General Assembly met, and it is hereby enacted by the authority of the same, That the subscribers to the association called The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, and all such persons as may hereafter be admitted members of the same, shall be, and they are hereby declared to be, a body politic and corporate, by the name and style of "THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS," to have perpetual succession, to sue and be sued, implead and be impleaded, in all courts of record or elsewhere, to use a common seal, and break, alter, and renew the same at pleasure, and to take, hold, and enjoy lands, tenements, and hereditaments; Provided that the yearly income of the real estates held by them shall not exceed two thousand dollars.

SEC. 2. And be it further enacted by the authority aforesaid, That the objects of the said corporation shall be the promotion and encouragement of manufactures and the mechanic and useful arts, by the establishment of popular lectures on the sciences connected with them, by the formation of a cabinet of models and minerals, and a library, by offering premiums on all objects deemed worthy of encouragement, by examining all new inventions submitted to them, and by such other measures as they may judge expedient.

SEC. 3. And be it further enacted by the authority aforesaid, That the members of the said corporation shall consist of manufacturers, mechanics, artisans, and persons friendly to the mechanic arts; they shall pay such sum annually, or in gross, as shall be required by the by-laws of the said corporation for an annual, or life, subscription; Provided that nothing herein contained shall be construed to prevent the said corporation from electing honorary or corresponding members, who may be exempted from such payments and other duties of membership, in such manner and to such extent as may be prescribed by the by-laws of the said corporation.

SEC. 4. And be it further enacted by the authority aforesaid, That the officers of the said corporation shall be a president, two vice-presidents, a recording secretary, a corresponding secretary, a treasurer, and twenty-four managers, who shall, together, constitute a board of managers of the said corporation, and such other officers as the said corporation shall deem needful; two-thirds of the managers shall be manufacturers or mechanics; the

said officers shall be elected at an annual meeting of the said corporation, to be held on the third Thursday of January; if an election shall not take place on that day, the corporation shall not for that cause be dissolved, but an election shall be held as soon afterwards as may be, and until such election the officers in place shall continue to act; public notice of all elections shall be given in such manner as may be prescribed by the by-laws of the said corporation; the present officers of the said association are hereby constituted the officers of the corporation hereby created; and shall continue to hold their respective offices till otherwise elected under the provisions of this act; Provided always, that the said corporation shall have power to increase the number of vice-presidents and managers hereinbefore mentioned, to such number as may be deemed advisable and convenient at a stated meeting of the said corporation, the same public notice of such intended alteration being previously given as may be required to be given of the election of officers of the said corporation.

SEC. 5. And be it further enacted by the authority aforesaid, That the duties and rights of the members of the said corporation, the powers and functions of the members of the said corporation, the powers and functions of the officers thereof hereinbefore mentioned, and of such others as may hereafter be added, the mode of supplying vacancies in office, the times of meeting of the said corporation, and of the board of managers, the numbers which shall constitute a quorum at any such meetings, the mode of electing members, the terms of their admission, the causes which shall justify their suspension or expulsion from the corporation, and all other concerns of the said corporation shall be regulated by the by-laws and ordinances of the said corporation hereafter to be made, which the said corporation is hereby authorized and empowered to make and alter, in the manner which may be therein mentioned; Provided that the said by-laws or ordinances shall not be repugnant to, or inconsistent with, the constitution or laws of the United States or of this Commonwealth.

OFFICE OF THE CLERK OF THE SENATE OF THE COMMONWEALTH OF PENNSYLVANIA,

March 30th, 1824.

I certify that the foregoing Bill passed both branches of the Legislature, and received the signature of the Governor on this day. As witness my hand the day and year above written.

(Signed.)

JNO. DUPUY, *Clerk.*

An Act to amend and alter the Act incorporating The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts.

WHEREAS, The Act approved March thirtieth, one thousand eight hundred and twenty-four, incorporating The Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, has been found insufficient and inconvenient for accomplishing the objects of said corporation, and the said corporation has applied for alteration and amendment thereof.

SECTION 1. Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania, in General Assembly met, and it is hereby enacted by the authority of the same, that the present members of said corporation, and all such persons as may hereafter become members thereof, shall be, and are hereby created, a body politic and corporate by the name of "THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS," and shall have perpetual succession, be able to sue and be sued, to plead and be impleaded, to have and use a common seal, and the same to break, alter and renew at pleasure, and shall be able to take, hold, purchase and enjoy such real and other estates of any nature or kind whatsoever as they may obtain by purchase, devise, bequest or gift, and the same at their pleasure to sell, lease, mortgage, pledge, encumber, or dispose of as they may deem proper or convenient for promoting the objects of the said corporation; and the said corporation shall have the like power over any real estate or other estates now owned or held by them; *provided*, that the clear yearly value of the real estate at any time held by them shall not exceed ten thousand dollars.

SEC. 2. That it shall be lawful for the said corporation to raise funds for the payment of its present indebtedness, and for all other purposes of the said corporation, to create and sell such number of shares of stock, at ten dollars each, as may be deemed proper to represent the estates of the said corporation, and the certificates of such stock shall be in such form, be transferable in such manner, subject to such payments, and entitle the holder thereof to such privileges, as the said corporation may, by its By-Laws in reference to such stock, grant and direct.

SEC. 3. The object of the said corporation shall be the promotion and encouragement of manufactures and the mechanical and useful arts, by the establishment of lectures on the sciences connected with them, by the formation of cabinets of models, minerals, machines, materials and products, by exhibitions and premiums, by a library and by all such measures as they may judge expedient.

SEC. 4. The members of the said corporation shall consist of manufacturers, mechanics, artisans, and persons friendly to the mechanic arts, and of such stockholders in said corporation as may, by the By-Laws, be entitled to the privileges of members; and every member shall pay such sum for an annual or life subscription as the By-Laws of said corporation may require; and honorary and corresponding members may be elected at such times, and in such a way, and with such privileges as said corporation may deem expedient.

SEC. 5. The said corporation shall be managed in such way, and by such number of officers, managers and other persons as the By-Laws may prescribe, and the powers and functions of such officers, managers or other persons, the rights and duties of members, the manner of their election, and the causes which may justify their expulsion or suspension, and all other concerns of the said corporation, shall be fixed and regulated by its By-Laws, which By-Laws shall be adopted by said corporation at the first monthly meeting after the acceptance of this amended Charter, and said By-Laws

shall be altered and amended only in the manner provided in said By-Laws as then adopted.

SEC. 6. So much of the Act to which this is a supplement as is inconsistent herewith is repealed.

OFFICE OF THE SECRETARY OF THE COMMONWEALTH OF PENNSYLVANIA,

April 25th, 1864.

I certify that the foregoing bill passed both branches of the Legislature, and received the signature of the Governor on this day. As witness my hand the day and the year above written.

(Signed.)

ELI SLIFER, *Secretary of the Commonwealth.*

BY-LAWS OF THE INSTITUTE

ARTICLE I.—*Trustees.*

SECTION 1. All Real and Personal Estate of the Institute which may hereafter be acquired by voluntary subscription or devise, bequest, donation, or in any way other than through its own earnings or by investment of its own funds, saving where the donors shall expressly provide to the contrary, shall be taken as acquired upon the condition that the same shall be vested in a Board of Trustees, who shall be appointed in the manner hereinafter indicated. Unless the title to such property shall be directly vested in said Board of Trustees by the donors, the Institute, by deed attested by the President and Secretary, which they are hereby authorized to execute and deliver, shall forthwith convey the same to said Trustees, who shall hold it in trust for the purposes specifically designated by the donors; or, if there shall be no specific designation, for the benefit of the Institute in the way and manner hereinafter provided, so that the same shall not, in any event, be liable for the debts of the Institute.

SEC. 2. Said Board of Trustees shall be composed of seven (7) members, originally elected by the Board of Managers on its own nomination.

Vacancies, as they occur, shall be filled by election by the Board of Managers from nominations made by the remaining Trustees to a stated meeting of the Board of Managers at least one month prior to the election; the Board of Managers to have the right to reject any nominations not satisfactory to them.

The remaining members of the Board of Trustees, whenever at any time it shall be deemed necessary to do so, shall have power to assign and convey the property held by them, so as to vest the title thereto in themselves and their successors.

SEC. 3. Said Trustees shall have full power and authority, from time to time, to assign, sell and dispose of any property, real and personal, by them held, unless there shall be some direction by the donors to the contrary, and shall have power to convey the same without purchasers being obliged to see to the application of the purchase moneys, when authorized so to do by a

vote of two-thirds ($\frac{2}{3}$) of the members present at any regular or special meeting of the Board of Managers; *provided*, that they shall not be obliged to sell or convey unless a majority of their own Board shall also approve.

SEC. 4. Said Trustees shall not be confined to legal investments, but shall have full power to invest in any real property, improvements and alterations, and in any securities, other than shares of stock, or unusual personal obligations, which to them may seem advisable.

SEC. 5. Said Trustees shall have power to appoint agents to act for them, and for the acts of such agents they shall not be personally responsible where they have exercised ordinary prudence in selecting them.

SEC. 6. Said Trustees shall have power to carry into effect any special trusts upon which any property may be held by them. They shall pay out all necessary and proper costs, charges and expenses, and from time to time shall pay over the net income to the Board of Managers, to be applied by them to the uses of the Institute in accordance with the terms of the trusts from which the income is derived.

The principal and interest of all trust funds shall not be liable for debts of the Institute but shall be devoted to its continuance and preservation.

SEC. 7. At the annual meeting of the Board of Managers in each year, said Board of Trustees shall present report of their proceedings and a detailed statement of their receipts and expenditures for the year. An approval of such account shall be final and conclusive, and shall bar any right to demand any other or further accounting.

SEC. 8. The Board of Trustees, at a meeting of the members of the Institute, called after three (3) months' special notice, at which the holders of nine-tenths ($\frac{9}{10}$) of the whole outstanding shares of stock shall vote affirmatively, may convey all property, real and personal, in them vested, to the Institute, free and clear of all trusts: *provided*, that there be no specific trusts violated by such conveyance, and that all the members of said Board, as the same shall then be constituted, shall approve of such conveyance.

ARTICLE II.—*Stock.*

SECTION 1. The Real and Personal Estates of the Institute as held upon the First day of January, One Thousand Eight Hundred and Eighty-one, shall be valued at One Hundred Thousand Dollars, and shall be represented by Ten Thousand Shares of Stock of the par value of Ten Dollars each. Said shares shall be divided into two classes, viz.:—

First Class.—Shares not registered for use: on which no annual payment shall be charged or collected, and the holders thereof shall not have the privileges of members of the Institute, but may, if of legal age, vote at any annual election for officers, managers and auditors, upon the payment of One Dollar upon each share of stock on which they may desire to vote; *provided, however*, such shares have been held by the same person at least three months before such election.

Shares of the First Class may be converted into shares of the Second Class at the pleasure of the owners, provided the transfer be approved by the Board of Managers; but, when once so converted, they shall always continue in the Second Class.

Second Class.—Shares registered for use: on which Twelve Dollars per annum shall be due and payable from resident members in advance on the first day of October in each year, except as hereinafter provided.

Non-resident holders of Second Class stock shall pay an annual fee of Five Dollars.

SEC. 2. The holders of Second Class stock shall be entitled to the use of the library, lectures and reading-room; and, if of legal age, to all other privileges of membership in the Institute, so long as they make the annual payment in advance; and shall, on the payment of One Dollar therefor, be entitled to a Certificate of Membership.

SEC. 3. If the annual dues for successive years remain unpaid at the expiration of two and a half years on any share of stock of the Second Class, such share shall then become forfeited to the Institute; but such forfeiture may be remitted by a unanimous vote of the Board of Managers.

SEC. 4. Stock of the Second Class may be held in trust for persons not of legal age, and shall be liable to the payment of only one-half the annual fees due upon stock of Second Class held by persons of legal age; *provided*, that when such minors arrive at legal age, new certificates, subject to the full annual contribution, shall issue on payment of the customary fee.

SEC. 5. Certificates for the First Class stock may be issued for any number of shares in a single certificate; but every certificate for the Second Class shall be for one share only.

SEC. 6. No share of stock in the Second Class shall be transferred until all arrearages and fines are paid, and all books and tickets returned, and the transfer approved by the Board of Managers.

SEC. 7. All certificates of stock shall be signed by the President and Secretary; shall be issued by the Actuary, and shall be transferable only on the books of the Institute by the owner, or his legal representative, on the surrender of the old certificate, and of a fee of twenty-five cents for each certificate.

SEC. 8. All subscriptions to stock shall be approved by the Board of Managers before the certificate can be issued.

SEC. 9. The shares of stock obtained by the Institute by legacies, donations, or forfeiture shall at once be cancelled.

ARTICLE III.—*Members.*

SEC. 1. The members of the Institute shall consist of manufacturers, mechanics, artisans, and persons friendly to the mechanic arts, and they may be either annual contributors, associate members, life members, permanent members, holders of Second Class stock, honorary or corresponding members.

SEC. 2. The privileges of membership, other than associate membership, in the Institute shall extend only to persons of legal age who are not in arrears and who shall have signed the Charter and By-Laws.

SEC. 3. Annual contributors shall pay yearly dues of Fifteen Dollars; shall be entitled to all of the privileges of the Institute, and shall be eligible to any office or to membership upon any committee.

SEC. 4. Non-resident annual contributors shall pay an entrance fee of Five Dollars and annual dues of Five Dollars.

SEC. 5. Associate members shall be over seventeen and under twenty-five years of age. They shall have the right to attend all meetings of the Institute, use the library, receive the JOURNAL and serve upon committees, but they shall not have the right to vote or to hold office. They shall pay annual dues of Five Dollars. The term of an associate member shall be limited by the age of twenty-five years, after which he shall become an annual contributor with the dues and privileges of that class and he shall be duly notified of the transfer.

SEC. 6. Annual contributors, whether resident, non-resident or associate members, shall be elected by the Board of Managers.

SEC. 7. Honorary and Corresponding Members shall be nominated by the Board of Managers, and shall require for their election four-fifths of the votes of the members present, at any meeting of the Institute at which their nomination may be acted upon. They shall pay no dues.

SEC. 8. Life members, whose membership shall not be transferable, may be elected by the Board of Managers upon the payment of Two Hundred Dollars in any one year.

Non-resident Life members may be elected in the same way upon payment of Seventy-five Dollars in any one year.

SEC. 9. A permanent membership, which may be transferred by will or otherwise, subject to the approval of the Board of Managers, may be granted by the Board of Managers to any one who shall contribute to the Institute for that purpose the sum of One Thousand Dollars in any one year.

SEC. 10. Non-resident members shall be those who reside permanently at a distance not less than twenty-five miles from Philadelphia. Transfers of membership from the resident to non-resident class may be granted by the Board of Managers at its discretion in cases of temporary absence of a member from the city for a period of not less than one year.

SEC. 11. Members shall be entitled to a Certificate of Membership on payment of One Dollar.

SEC. 12. Resignations of membership shall be made to the Board of Managers in writing, but shall not be accepted until all dues, fines, and arrears of dues and current dues at the annual rate up to the date of resignation, shall have been paid, and books and tickets returned.

ARTICLE IV.—*Payments of Dues.*

SECTION 1. The annual payment of fees for membership shall be due and payable on the first of October in each year, in advance; but all members elected after the 31st of March in each year shall pay, in advance, for the current year, one-half of the annual dues.

SEC. 2. Any member whose dues are more than three months in arrears shall be notified by the Actuary. Should such dues not be paid when they become six months in arrears, the privileges of membership shall by that fact be suspended. When nine months in arrears such member shall be

again notified, and if such dues become one year in arrears, the said member shall by that fact forfeit all connection with the Institute. The Board of Managers, however, may, for cause by it deemed sufficient, extend the time for payment and for the application of these penalties.

The Board of Managers may, for sufficient cause, temporarily excuse from payment of annual dues any member who from ill health, advanced age or other good reason assigned, is unable to pay such dues; and the Board may remit the whole or part of the dues in arrears or accept in lieu thereof service or material contributed to the Institute.

SEC. 3. Every person admitted to membership in the Institute shall be considered as liable for the payment of dues until he shall have resigned, been dropped or have been relieved therefrom by the Board of Managers.

SEC. 4. The annual dues from contributing members may be applied to the current expenses of the Institute, but all moneys received from life and permanent membership shall be vested in the Board of Trustees, the income therefrom only to be applied to the maintenance fund.

ARTICLE V.—*Officers.*

The officers shall be a President, three Vice-Presidents, a Secretary, a Treasurer, and twenty-five Managers. A majority of the Managers shall be persons directly interested in industrial pursuits.

ARTICLE VI.—*Election of Officers.*

SECTION 1. An election for officers shall be held on the third Wednesday in January in each year. At this election the President and the Treasurer shall be elected to serve one year, and one Vice-President, and eight Managers, shall be elected to serve for three years; *provided*, that the officers now elected or who may hereafter be elected, shall continue to serve until their successors be elected.

One Manager, to be known as the Alumni Manager, shall be elected in January of every third year, beginning in the year 1910, by the Alumni Association of the Institute, to serve for three years. A vacancy in this position shall be filled by election in the same manner for the unexpired term.

The Secretary shall be elected by the Board of Managers at their first stated meeting after the annual election each year.

SEC. 2. All elections for officers of the Institute shall be by letter ballot, and no vote may be cast by proxy, nor received from a member in arrears.

SEC. 3. Nominations for the annual election for officers shall be presented in writing at the stated meeting in the month of December. Each nomination paper must be signed by at least two members in good standing, who shall certify that the candidate will serve if elected. After the nominations are closed, the President shall appoint three members, who are neither officers nor nominees, to act as tellers of the election. The list of nominees shall promptly be posted at the Institute and incorporated (with directions for voting) in a ballot to be sent to each member by the Secretary at least one week before the date of the election. Each ballot shall be accompanied by a

return envelope addressed "To the Tellers of Election," and provided with a space for the signature of the member voting.

SEC. 4. On the date of the annual election, and at an hour previously designated by their chairman, the tellers shall meet at the Institute and shall count all legal votes that have been received by mail or placed in the ballot box before 8 o'clock P.M.; and when the count is completed they shall report to the annual meeting of the Institute the total number of ballots cast, together with the number of votes received by each candidate. Thereupon the presiding officer shall announce the names of the candidates who received the plurality of votes for each office, and shall declare them elected officers of the Institute for the ensuing terms.

ARTICLE VII.—*President.*

It shall be the duty of the President, or, in his absence, of one of the Vice-Presidents, in order of seniority of election, or, in their absence, of a President to be chosen *pro tempore*, to preside at all meetings of the Institute and of the Board of Managers.

ARTICLE VIII.—*Secretary.*

SECTION 1. The Secretary of the Institute shall be a person of scientific attainments. He shall receive such salary as may be fixed by the Board of Managers.

SEC. 2. He shall have general charge and supervision, subject to the Board of Managers, of all the work of the Institute, and of its library, museum, laboratories, and property in general.

SEC. 3. He shall keep the minutes of all meetings of the Institute; and shall perform all the duties usually pertaining to the office of secretary.

SEC. 4. He shall be *ex officio* a member of the Board of Managers and of all standing committees of the Institute.

SEC. 5. As *ex officio* Secretary of the Committee on Science and the Arts he shall attend all meetings of that Committee and keep the minutes thereof. He shall also attend meetings of sub-committees at which his attendance has been requested, and when desired shall aid sub-committees in making searches and in the examination of authorities, documents, apparatus, etc.

Two weeks before each stated meeting of the Committee he shall report to its Chairman the status of all investigations pending before the sub-committees.

He shall also perform any other duty that may tend to advance the work of the Committee.

With the approval of the Board of Managers he may appoint an assistant to perform some, or all of his duties as Secretary of this Committee.

ARTICLE IX.—*Treasurer.*

It shall be the duty of the Treasurer to receive from the Board of Trustees all funds, which they may pay over to the Board of Managers in

accordance with Section 6 of Article I. He shall also receive all moneys collected for the Institute by the Actuary. He shall deposit all moneys received, in the name of the corporation, in such institution as the Board of Managers may direct. He shall make no payments without written vouchers from the Board of Managers. He shall keep accurate accounts of the income and disbursements of the Institute, exhibit an accurate statement of his receipts and payments at each stated meeting of the Board of Managers, and of the condition of the finances of the Institute whenever called on by them, and shall make an annual statement thereof at the annual meeting of the Institute. He shall give bonds to an amount fixed by the Board of Managers for the faithful performance of his trust. In case of a vacancy in the office of treasurer, it shall be the duty of the Board of Managers to appoint a person to perform the duties of the position *pro tempore*.

ARTICLE X.—Board of Managers.

SECTION 1. The Board of Managers shall consist of 25 members elected as provided in Article VI; all officers of the Institute, *ex officio*, except the Trustees; and the Chairman of the Committee on Science and the Arts' *ex officio*.

The Board of Managers shall have entire charge and control of the current receipts and expenditures of the Institute, and of all its business affairs not specially reserved to the Board of Trustees, and shall have authority to do all acts not inconsistent with the rights and duties of the Trustees which may in their judgment advance the interests of the Institute.

They shall have authority, by exchange, sale or otherwise, to add to or subtract from the collections of books, furniture and apparatus, in such manner, however, that the aggregate value of the same to the Institute, at any time, may not be impaired.

They shall have authority to elect members of the Institute, except Honorary and Corresponding Members, who shall be elected by the Institute.

SEC. 2. They shall keep regular minutes of their proceedings, which shall be open at all times to inspection by members of the Institute.

SEC. 3. They shall present, at the annual meeting of the Institute, a report of their proceedings and of the condition of the affairs of the Institute.

SEC. 4. They shall hold stated meetings once in each month. They shall elect their own officers, except the chairman, who shall be the President of the Institute, or in his absence, as provided for in Article VII, and shall be at liberty to make by-laws for their own regulation not inconsistent with the Charter, or with the By-Laws of the Institute. Seven of their members shall constitute a quorum.

SEC. 5. All vacancies in the Board of Managers shall be filled by an election at the next stated meeting of the Institute.

ARTICLE XI.—Audits.

The accounts of the Treasurer and Board of Trustees shall be audited

at least once a year by certified public accountants, who shall report to the Board of Managers.

ARTICLE XII.—*Committees of the Institute.*

SECTION 1. There shall be the following Standing Committees, each to consist of ten members, to be appointed by the President, at the first meeting after the annual election, who may be aided in his choice by nominations made at the annual meeting. All members notified of their appointment to any committee, if they do not decline before the next stated meeting, shall be considered members thereof:—

1. On the Library.
2. On the Museum.
3. On Meetings.

SEC. 2. There shall be a Committee on Science and the Arts, consisting of sixty members of the Institute, who shall pledge themselves by their acceptance of membership to perform such duties as may devolve upon them and to sustain by their labors the scientific character of the Institute.

They shall be elected by the Board of Managers at its stated meeting on the fourth Wednesday of January, twenty members being elected each year to serve for three years.

The Secretary shall report to the Board of Managers at said meeting the number of vacancies on the Committee from any cause, and the names of those whose terms expire that year, together with the record of their attendance at meetings of the Committee, and a brief summary of their participation in the work of the Committee and its sub-committees. Vacancies occurring during any year may be filled by the Committee itself by election of members to serve until the following January.

Within one month after the Annual Election, the Committee shall hold a meeting at which it shall elect a Chairman for the current year.

It shall be the duty of the Committee to investigate and report upon any subject referred to it by a vote of the Institute, or any Section thereof, and at its discretion to investigate other subjects on application.

Applications for the examination of any subject shall be made to the Committee, either by recommendation of the Institute, or any Section thereof, or by requests from inventors or others, under the regulations of the Committee.

It shall also be the duty of the Committee to make or recommend the award of medals and other forms of recognition established by, or in charge of, the Institute.

Sub-committees to examine any subject shall be appointed by the Chairman of the General Committee from its membership, but they may include a minority of persons who are not members of the General Committee or of the Institute, but whose expert services are desired in the examination.

Reports of sub-committees shall be made to the General Committee in writing.

Final action on a report conferring or recommending an award shall not be taken by the General Committee except at the second or two successive stated meetings at which it has been read and been open for discussion and amendment.

A quorum for final action upon a report conferring or recommending an award shall consist of not less than fifteen members, and when such report is adopted it shall be accepted as the decision of the Institute.

Reports when issued after final adoption shall set forth that they are the action of The Franklin Institute by its Committee on Science and the Arts. They shall be signed by the President and the Secretary of the Institute and by the Chairman of the Committee; and the seal of the Institute shall be affixed thereto. The Committee may provide that such reports shall also be signed by the members of the respective sub-committees who made the investigations and prepared the reports.

The Chairman of the Committee shall submit to the stated meetings of the Board of Managers in October, December, February, April, and June of each year, a report of the number of investigations pending before the Committee, the number disposed of since the last report, with the action taken or award made in each case, and the number and nature of new investigations undertaken since the last report, and such other information as to the work of the Committee as the Board of Managers may require.

He shall also report to the stated meetings of the Institute such recent action of the Committee as he may deem of interest.

At the request of the Committee on Publications, and to make an adopted report more suitable for use in the JOURNAL of the Institute, the sub-committee that prepared the report shall have authority to amplify or abridge it without in any way changing its meaning or recommendation for award; but the fact of such modification must be stated as a note at the beginning of its publication in the JOURNAL.

SEC. 3. Each committee named in the first and second sections shall choose a chairman at its first meeting after its appointment.

Record of their proceedings shall be kept by the Secretary. They shall report to the Institute, and when required to the Board of Managers.

They shall be governed by such rules, not inconsistent with these By-Laws, as may be adopted by them respectively.

The Committees on the Library, on Meetings, and on Science and the Arts, shall meet at least once in each month, except in July and August.

SEC. 4. No bills for expenses incurred by committees shall be paid unless approved by the Committees which incurred them.

ARTICLE XIII.—*Meetings.*

SECTION 1. The Institute shall hold stated meetings on the third Wednesday of each month, except in June, July, August, and September. That on the third Wednesday in January of each year shall be the annual meeting.

SEC. 2. Special meetings shall be called by order of the President, upon request of the Board of Managers, or the written application of twelve members of the Institute. Fifteen members shall constitute a quorum.

ARTICLE XIV.—*Order of Business.*

SECTION 1. The stated meetings of the Institute shall be held at the hour of 8 o'clock P.M.

SEC. 2. The order shall be as follows:

1. Reading of the Minutes.
2. Reports from the Board of Managers.
3. Reports from the Standing Committees, etc.
 - (1) On the Library.
 - (2) On the Museum.
 - (3) On Meetings.
 - (4) On Science and the Arts.
4. Reports from Special Committees.
5. The paper announced for the evening.
6. The Secretary's report.
7. Deferred business.
8. Consideration of new business.

SEC. 3. At the annual meeting, the tellers' report may be received and read by the Secretary immediately after the conclusion of any number of the order of business.

SEC. 4. The order of business may be altered for any meeting by a vote of two thirds of the members present thereat.

ARTICLE XV.—*Rules.*

The Institute, at its meetings, shall be governed by Roberts' Rules of Order.

ARTICLE XVI.—*Organization and Government of Sections.*

SECTION 1. For the promotion and encouragement of manufactures and the mechanic arts, as well as of the sciences connected with them, members of the Institute may form sections and hold meetings in such rooms as may be provided for them by the Board of Managers. These sections shall be constituted as hereinafter provided, and shall have precedence in the order of their formation.

SEC. 2. Any number of members, not less than twelve, may constitute a section.

SEC. 3. Members desiring to form a section shall make written application to that effect to the Committee on Sectional Arrangements, which committee shall report such applications to the Board of Managers.

If the application shall be approved by the Board of Managers, the section shall be established and the names of the petitioners shall be recorded on the minutes as the founders of that section, and shall be reported by the Board of Managers to the Institute at its next meeting. Whenever the petitioners shall have organized, they shall report such organization, with the names of their officers, to the Committee on Sectional Arrangements. But if they shall fail to organize such section within six months after the date of said approval, or if an established section shall fail to make a report of its proceedings to the committee during any period of twelve months, it

shall be the duty of the Committee on Sectional Arrangements to inform the Board of Managers, which may thereupon declare that such section is extinct.

SEC. 4. All members of the Institute shall have the privilege of enrolling themselves, without payment of additional fees, as members of any of the sections which are now, or which may hereafter be, established in conformity with these By-Laws, and such enrollments shall be reported from month to month to the secretaries of the sections designated; but no person shall be entitled to any of the privileges of any of the sections who has not complied with the condition of Article III of these By-Laws.

SEC. 5. Each section shall submit to the Committee on Sectional Arrangements prior to the stated meeting of the Board of Managers in December of each year, an estimate of moneys it will require for the ensuing year, and such estimate the Committee on Sectional Arrangements shall transmit, with its recommendation, to the Board at its stated meeting in December.

SEC. 6. Each section shall elect its own officers and make its own by-laws, not inconsistent with the Charter and By-Laws of the Institute. The Institute shall not be responsible for bills contracted by any section in conformity with the conditions prescribed in Section 4 of Article XII of the By-Laws relating to committees, nor in any event for a sum greater in any one year than the amount appropriated by the Board of Managers for the service of the section for that year.

SEC. 7. All requisitions for supplies shall be made by order upon the Actuary of the Institute.

SEC. 8. The books, papers, apparatus, specimens, models, and all other collections of each section, shall be the property of the Institute, held for the use of that section. Donations of objects or books to or for any section, shall be received and reported to the Committee on Sectional Arrangements, and by this committee to the Board of Managers, as donations to the Institute for the use of that section.

SEC. 9. Each section shall determine, subject to the approval of the Board of Managers, the times of its stated meetings.

SEC. 10. Papers read and lectures delivered before any section and approved by the same, shall be referred to the Committee on Publications of the Institute, and if accepted by them, shall be published in the JOURNAL of the Institute.

SEC. 11. Societies now existing, or which may hereafter be founded, for the consideration of any subjects clearly within the scope of The Franklin Institute, and which societies may desire to unite with The Franklin Institute as sections, shall furnish a list of such of their members as have declared their willingness to become members of the Institute, to the Committee on Sectional Arrangements, which committee shall transmit the same, with its recommendation, to the Board of Managers.

SEC. 12. On all points not herein provided for, each section shall be governed by the Charter, By-Laws and usages of the Institute.

ARTICLE XVII.—*Amendments.*

Proposals for amendments to these By-Laws shall be presented in writing, signed by two members in good standing, at any stated meeting of the Institute. By a majority vote of the members present at this meeting they may be considered, amended, referred, postponed, rejected, or ordered to be voted upon at the date of the next stated meeting, until which time they shall be posted at the Institute. The final vote upon amendments shall be by ballot, and if two-thirds of the votes cast are in favor of any proposed amendment, it shall be declared adopted; except that amendments to Article II, relating to capital stock, must (subsequently) be ratified by a majority of the stock represented at a meeting specially called for this purpose.

BY-LAWS OF THE BOARD OF MANAGERS

(*As Amended June 8, 1910.*)

SECTION 1. *Officers.*—The President of the Institute, or, in his absence, the Vice-President, in order of seniority of election, or in the absence of both, a member elected *pro tempore*, shall preside at all meetings of the Board. Records of its proceedings shall be kept by the Actuary.

SEC. 2. *Meetings.*—The Board shall hold a meeting for the purpose of organizing, electing a Secretary, and a Committee on Science and the Arts; and appointing an Actuary, Standing Committees, etc., on the fourth Wednesday in January, and regular meetings on the second Wednesday of each month, at 3.30 o'clock P.M.

SEC. 3. Special meetings may be called by the President at his discretion, and shall be called on written request of five members of the Board. In case of his absence or refusal to act, such special meeting shall be called by the Actuary.

SEC. 4. *Actuary.*—An Actuary shall be appointed by the Board at their first meeting after the annual election. He shall keep a correct record of their proceedings; keep a roll of the members, and note their attendance thereon; give notice of all meetings of the Board, and of Committees, delivered at least two days prior to the day of meeting; act as Secretary of the following Standing Committees of the Board: on Election and Resignation of Members; on Stocks and Finance; on Exhibitions; on Endowment. He shall notify all committees of the Board of their appointment. He shall collect and receive all moneys due to the Institute, and hand them over to the Treasurer; shall act as agent of the JOURNAL of the Institute, and shall transact such other business of the Institute as the Board shall direct. In all matters he shall be subject to the direction and control of the Board, and he shall receive such yearly compensation as they may determine.

SEC. 5. *Secretary.*—The Secretary of the Institute shall be *ex officio* a member of and act as secretary of the following Standing Committees of the Board: on Instruction; on Publications; on Sectional Arrangements; Executive.

AWARDS BY THE INSTITUTE

The following awards are made by The Franklin Institute:

- The Franklin Medal.**
- The Elliott Cresson Medal.**
- The Howard N. Potts Medal.**
- The Edward Longstreth Medal.**
- The Certificate of Merit.**
- The Boyden Premium.**

The making or recommending of these awards is, by resolution of the Institute, entrusted to its Committee on Science and the Arts, a Committee consisting of sixty members of the Institute. This Committee recommends to the Institute the award of the Franklin Medal to distinguished scientists or technologists; and investigates, upon application, and reports on any worthy invention, discovery of process, recommending the award, according to merit, of the Elliot Cresson Medal, the Howard N. Potts Medal, the Edward Longstreth Medal, or the Certificate of Merit.

The Franklin Medal (Gold Medal and Diploma).—This medal is awarded annually from the Franklin Medal Fund, founded January 1, 1914, by Samuel Insull, Esq., to those workers in physical science or technology, without regard to country, whose efforts, in the opinion of the Institute, acting through its Committee on Science and the Arts, have done most to advance a knowledge of physical science or its applications.

The Elliott Cresson Medal (Gold Medal and Diploma).—This medal is awarded for discovery or original research, adding to the sum of human knowledge, irrespective of commercial value; leading and practical utilizations of discovery; and invention, methods or products embodying substantial elements of leadership in their respective classes, or unusual skill or perfection in workmanship.

The Howard N. Potts Medal (Gold Medal and Diploma).—This medal is awarded for distinguished work in science or the arts; important development of previous basic discoveries; inventions or products of superior excellence or utilizing important principles; and for papers of especial merit that have been presented to the Institute and published in its JOURNAL.

The Edward Longstreth Medal (Silver Medal and Diploma).—This medal, with a money premium when the accumulated interest of the fund permits, is awarded for meritorious work in science or the arts. In the

event of an accumulation of the fund for medals beyond the sum of one hundred dollars, it is competent for the Committee on Science and the Arts to offer from such surplus a money premium for some special work on any mechanical or scientific subject that is considered of sufficient importance.

The Certificate of Merit.—A Certificate of Merit is awarded to persons adjudged worthy thereof for their inventions, discoveries or productions.

The Boyden Premium (Premium of \$1000).—To any resident of North America who shall determine by experiment whether all rays of light and other physical rays are or are not transmitted with the same velocity.

HISTORY OF THE MEDALS.

The Franklin Medal.—Samuel Insull, Esq., of Chicago, Illinois, writing under date of December 23, 1913, to the Board of Managers, stated that he had been informed it would be a source of gratification to them if the Institute had available, in addition to such medals already in its gifts, a medal to be known as The Franklin Medal, and to be awarded from time to time in recognition of the total contributions of individuals to science or to the applications of physical science to industry, rather than in recognition of any single invention or discovery, however important. He agreed to provide for the founding of this medal under the following general conditions:

1. That an amount not exceeding one thousand dollars should be furnished by him for procuring appropriate designs and dies for the medal and diploma.

2. That the medal should possess distinct artistic merit, and have on one side a medallion of Benjamin Franklin done from the Thomas Sully portrait in the possession of the Institute.

3. That the medal should be of gold and have an intrinsic value of about seventy-five dollars.

4. That the sum of five thousand dollars should be provided by him to be held in trust in perpetuity to be a foundation for this medal, and to be known as The Franklin Medal Fund (Founded January 1, 1914, by Samuel Insull, Esq.).

5. That the interest of this fund should be used from time to time in awarding The Franklin Medal to those workers in physical science or technology, without regard to country, whose efforts have, in the judgment of the Institute, done most to advance a knowledge of physical science or its applications.

6. That any excess of income from this fund, beyond such average annual sum as might be deemed necessary by the Institute for the number of medals it is considered best to award, might be used for premiums to accompany the medals.

Mr. Insull said he understood that the Institute would be glad to award, on the average, two Franklin Medals a year. Though this would leave little surplus, he inserted the sixth condition to prevent an undesirable accumulation of the fund.

'At the Stated Meeting of the Board of Managers, February 11, 1914, the above offer was accepted, and its acceptance was confirmed to Mr. Insull in the following resolutions:

"Resolved, That the Board of Managers of The Franklin Institute of the State of Pennsylvania accept the offer of Mr. Samuel Insull to establish The Franklin Medal, under the conditions named in his letter of December 23, 1913.

"Resolved further, that it is the sense of the Board of Managers of The Franklin Institute that Mr. Insull, in founding this Medal, has rendered a notable service in stimulating workers in Physical Science and Technology and has extended materially the useful activities of the Institute.

"Resolved further, that the thanks of the Board of Managers of the Institute be, and are hereby, extended to Mr. Insull for his generous and greatly appreciated action.

"Resolved further, that an engrossed copy of these resolutions be forwarded to Mr. Insull."

On March 24, 1914, Mr. Insull forwarded his check for six thousand dollars, and the following deed was duly executed and delivered:

KNOW ALL MEN BY THESE PRESENTS, That THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS, hereinafter named The Franklin Institute, for and in consideration of the sum of Six Thousand (\$6,000) Dollars to it in hand paid by Samuel Insull, Esq., the receipt whereof is hereby acknowledged, does hereby certify and declare that it holds and will use said sum of money for the following uses, intents and purposes, and upon the following perpetual trusts, that is to say:

1. To expend One Thousand (\$1,000) Dollars, or so much thereof as may be necessary, for the purpose of paying for the design of a medal, and the necessary dies and diploma plates for the purposes hereinafter set forth.

2. To invest and keep invested the balance of said sum, and from the income derived from such investments from time to time to strike off and award medals from said design to workers in physical science or technology, without regard to country, whose efforts, in the opinion of the Board of Managers of said The Franklin Institute, have done most to advance our knowledge of physical science or its application. Should the income derived from this fund be more than necessary for the purposes aforesaid, the said The Franklin Institute may, in its discretion, award so much of the surplus, as its Board of Managers deems wise, as premiums to accompany said medals.

3. The fund thus set apart shall be known as "The Franklin Medal Fund" (Founded January 1, 1914, by Samuel Insull, Esq.).

4. The medals to be awarded as aforesaid shall be of gold, shall have distinct artistic merit, shall be of the intrinsic value of about seventy-five (\$75) dollars, and shall have on one side thereof a medallion of Benjamin Franklin taken from his portrait by Thomas Sully, now in the possession of the said The Franklin Institute.

IN WITNESS WHEREOF, The said The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts has hereunto set its common or corporate seal, attested by the signatures of its President and Secretary, this 28th day of March, A.D. 1914.

WALTON CLARK,
President.

R. B. OWENS,
Secretary.

[SEAL]

The Elliott Cresson Medal.—Under date of February 18, 1848, Elliott Cresson, Esq., of Philadelphia, Pennsylvania, conveyed to the Trustees for The Franklin Institute one thousand dollars of the six per cent. convertible loan of the President, Managers and Company of the Schuylkill Navigation Company—to hold the said sum and the interest to accrue thereon, for the following uses and purposes:

1. The trustees to keep the principal invested as it now (1848) is until it is reimbursed by the said Company, and immediately after such reimbursement to reinvest the said principal of one thousand dollars in such securities, bearing interest, as may by law be designated for the investment of trust funds. And from time to time, as the said principal sum may be reimbursed, to reinvest the same in like manner.

2. To cause suitable dies to be prepared for striking the gold medal out of the first sufficient moneys received for interest on the said sum of one thousand dollars, the dies to bear the following devices and inscriptions: The obverse,—a medallion likeness of the said Elliott Cresson with inscription around the margin, "Elliott Cresson Medal, A.D. 1848." Reverse,—around the margin, "Awarded by The Franklin Institute of Pennsylvania." The centre to be filled by engraving the name of the party to whom awarded and the year in which the award is made.

3. After the said dies have been prepared, and paid for out of the money received for interest, the said Trustees to cause to be struck, from time to time, such number of gold medals as the interest received will pay for, and to deliver the same to the Treasurer of The Franklin Institute, to be by him transmitted to such persons or parties as the said Franklin Institute may have awarded the same; the said awards, however, to be in all instances made either for some discovery in the arts and

sciences, or for the invention or improvement of some useful machine, or for some new process or combination of materials in manufactures, or for ingenuity, skill or perfection in workmanship.

The Howard N. Potts Medal.—Howard N. Potts, Esq., of Philadelphia, Pennsylvania, died July 24, 1906, leaving a will in which he provided for the establishment of this medal as follows:

"I give and bequeath to The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts and its successors, the sum of one thousand dollars, without deduction for taxes or charges; in trust to invest the same and apply the income thereof or such part or portion of it as may be adequate for the purpose, from time to time, to the purchase of a gold medal, to be awarded in the name of the said Franklin Institute for distinguished work in science or the mechanic arts."

The Edward Longstreth Medal.—In the month of May, 1890, Edward Longstreth, Esq., of Philadelphia, Pennsylvania, retired member of The Baldwin Locomotive Works, deposited with The Franklin Institute in trust, a registered bond of the Baltimore Traction Company for the sum of one thousand dollars, for the founding and perpetuation of the Edward Longstreth Medal of Merit; the interest accruing from said principal sum to be used in procuring and awarding said medals for the encouragement of invention, and in recognition of meritorious work in science and the industrial arts; the said awards to be made by The Franklin Institute through its Committee on Science and the Arts, under such rules as said Committee may adopt.

This donor further presented to The Franklin Institute twelve silver medals and the die therefor designed and executed under the direction of a committee of the Institute with his approval.

On May 14, 1890, the Board of Managers of The Franklin Institute, by resolution, accepted on behalf of the Institute the gifts of the donor, and on September 17, 1890, the Institute, by resolution following, confirmed the acceptance:

"Resolved, That the Institute hereby confirms the action of the Board of Managers in accepting the gift of foundation of the Edward Longstreth Medal of Merit, and in expressing its grateful acknowledgments for the gift.

"Resolved, That the grant of the Edward Longstreth Medal, in accordance with the wishes of the donor, be entrusted to the Committee on Science and the Arts, subject to such conditions as the said Committee, with the approval of the Institute, may propose."

The obverse of the medal bears the effigy of the donor, and is inscribed around the margin, "The Edward Longstreth Medal of Merit, Founded

1890." On the reverse is inscribed around the margin, "Awarded by The Franklin Institute," and in the centre is engraved the name of the recipient with the date and object of award.

On March 19, 1913, Charles Longstreth, son of the above-named Edward Longstreth, deposited with The Franklin Institute the further sum of one thousand dollars to be added to the original fund to be kept with it in trust in perpetuity, the interest to be used as is the interest of the original fund.

The Certificate of Merit.—At the stated meeting of the Institute, held on June 21, 1882, the following resolution was adopted:

"Resolved, That the Committee on Science and the Arts of The Franklin Institute is hereby authorized to award, and issue to persons by said Committee adjudged worthy, a Certificate of Merit for their inventions, discoveries or productions, which certificate shall read as follows:

'The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, awards to _____ this Certificate of Merit. This award is made pursuant to the recommendation of the Committee on Science and the Arts.

Report No. _____ Approved, _____ 19 _____

_____ *President.*

[SEAL]

_____ *Secretary.*

Chairman of the Committee on Science and the Arts.'"

The Boyden Premium.—On March 23, 1859, Uriah A. Boyden, Esq., of Boston, Massachusetts, deposited with The Franklin Institute the sum of one thousand dollars to be awarded as a premium to any resident of North America who shall determine by experiment whether all rays of light, and other physical rays, are or are not transmitted with the same velocity.

The problem has been more specifically defined by the Board of Managers, as follows:

"Whether or not all rays in the spectrum known at the time the offer was made, namely, March 23, 1859, and comprised between the lowest frequency known thermal rays in the infra-red, and the highest frequency known rays in the ultra-violet, which in the opinion of the Committee lie between the approximate frequencies of 2×10^{14} double vibrations per second in the infra-red and 8×10^{14} in the ultra-violet, travel through free space with the same velocity."

An award, made during the year 1907, covered the solution of the problem so far as the transmission of the visible and ultra-violet rays is concerned. It has been directed by the Board of Managers that the balance of the fund be retained, to be awarded to such person as shall demonstrate whether or not the infra-red rays are or are not transmitted with the same velocity as the other rays.

REGULATIONS OF THE COMMITTEE ON SCIENCE AND THE ARTS

ARTICLE I.—*Investigations.*

SECTION 1. The Committee shall investigate, by sub-committee or otherwise, any subject referred to it by the Institute or by any of its sections; and upon a majority vote of the members present at any stated meeting, it may investigate any subject presented on motion of a member or by application as herein provided.

SEC. 2. Secret processes of compounds will not be considered by the Committee; nor will the treatment of materials by any substance be considered, unless the composition used and the method of treatment are fully disclosed.

SEC. 3. An applicant for investigation of a subject will be furnished by the Secretary with a copy of the regulations governing investigations.

SEC. 4. An application for investigation shall be made in writing on a blank, substantially like "Form A" below, which may be obtained from the Secretary. This application shall be addressed to the Secretary, who will upon receipt refer it to the Sub-Committee on New Subjects and Preliminary Examination; this sub-committee shall recommend to the Committee its acceptance or rejection, upon which the Secretary shall notify the applicant accordingly.

SEC. 5. It shall not be competent for any member of the Committee on Science and the Arts to be an applicant for any of the awards in the gift, or under the recommendation, of the said Committee, unless the subject for award be referred to the Committee by a vote of the Institute.

ARTICLE II.—*Meetings of the Committee.*

SECTION 1. The Committee shall hold stated meetings at 8 o'clock P.M. on the first Wednesday of each month, excepting July and August.

SEC. 2. Special meetings may be called by the Chairman, and shall be called by him upon the written request of five members of the Committee.

SEC. 3. At all meetings of the Committee nine members shall constitute a quorum for transacting general business, but for final action upon a report conferring or recommending an award or for amending the rules of the Committee, a quorum shall consist of not less than fifteen members.

SEC. 4. At its stated meeting the Committee shall proceed in the following

Order of Business:

1. Calling the roll.
2. Reading of the minutes of preceding meeting.
3. Reading of correspondence.

4. Approval of bills.
5. Report of Sub-Committee on New Subjects and Preliminary Examination.
6. Reports of standing and special sub-committees.
7. Consideration of reports for final action.
8. Reports of sub-committees on investigation, first reading.
9. Deferred business.
10. New business.
11. Adjournment.

SEC. 5. Members shall not be entitled to the floor more than twice on any question without the consent of the Committee.

SEC. 6. There shall be no debate on points of order except on an appeal from the decision of the Chairman, or on a question referred by him to the Committee. In such cases no member shall have the floor more than once without the consent of the Committee.

ARTICLE III.—*Chairman.*

SECTION 1. Nominations for a Chairman to serve for one year shall be made at the stated meeting of the Committee in February, and the election shall be by ballot at the same meeting, when the person receiving the highest number of votes shall be declared elected. He shall immediately assume office and shall perform his duties until his successor is installed. He shall not be eligible for election in two successive terms.

SEC. 2. The Chairman shall appoint the members of all sub-committees unless otherwise ordered, and may serve *ex officio* on all sub-committees except those charged with investigations.

SEC. 3. The election of a member as Chairman shall be held to vacate his membership of any and all sub-committees on investigation on which he may be serving, except if he has the report of such Committee prepared or in preparation, in which case he shall complete his work, but when such report is presented for consideration, he shall call on another member to preside while the subject is under discussion.

SEC. 4. The Chairman shall submit to the stated meetings of the Board of Managers in October, December, February, April, and June of each year, a report of the number of investigations pending before the Committee, the number disposed of since the last report, with the action taken or award made in each case, and the number and nature of new investigations undertaken since the last report, and such other information as to the work of the Committee as the Board of Managers may require. He shall also report to the stated meetings of the Institute such recent action of the Committee as he may deem of interest.

ARTICLE IV.—*Standing Sub-Committees.*

SECTION 1. There shall be appointed each February by the Chairman a sub-committee of not less than five members of the Committee, to be styled the "Sub-Committee on New Subjects and Preliminary Examination." The

duties of this sub-committee shall be to keep a general observation of progress made in science and the arts and to report to the Committee subjects adjudged worthy of investigation; to co-operate with the Secretary in keeping the work of the Committee properly before the public, and to recommend at each regular meeting the acceptance or otherwise of all applications for investigation. This sub-committee shall meet at least once prior to each regular meeting of the Committee.

SEC. 2. There shall be appointed each April by the Chairman from the membership with the consent and approval of the Committee, a sub-committee styled the "Sub-Committee on Literature." It shall be the duty of this sub-committee to examine carefully all papers that have been presented to the Institute and published in its JOURNAL during the current year, and to report to the Committee not later than the following April meeting which of these papers deserve the award of, viz.:

1. *The Howard N. Potts Medal;*
2. *The Certificate of Merit.*

The Institute, through the Committee, may award said medals to the authors of papers so recommended, except that it shall not so award more than one Potts Medal in any one year.

The Sub-Committee on Literature shall also consider any publication or treatise devoted to science or the mechanic arts, submitted by the Committee, and if in its judgment said work appears to be of unusual merit it may recommend that its author be awarded the Potts Medal, provided that such medal shall not be so awarded more than once in any one year.

Advertisement of these awards shall not be required.

SEC. 3. There shall be appointed annually by the Chairman from the membership a sub-committee styled the "Sub-Committee on Awarding the Franklin Medal," the duty of which shall be to make recommendations of the award of this medal under the provisions of the deed of gift.

ARTICLE V.—*Sub-Committees on Investigation of Applications.*

SECTION 1. Upon the acceptance of an application for investigation, a sub-committee shall be appointed by the Chairman to conduct the investigation.

SEC. 2. Sub-committees shall be appointed from the membership of the Committee, but they may include a minority of other persons whose expert services are desired in the examination.

SEC. 3. When the personnel of a sub-committee on investigation is finally determined, a notice shall be sent to each member thereof giving the names of the members of the sub-committee and setting forth the regulations governing investigations.

SEC. 4. No person shall be a member of a sub-committee on investigation who is interested in the issue.

SEC. 5. After a subject has been assigned to a sub-committee for investigation it shall not be withdrawn without the consent of the Committee

SEC. 6. *Resignations.*—All resignations by members of the Board, after acceptance thereof, shall be reported to the Institute at its next stated meeting.

Members who have not attended six regular meetings prior to the stated meeting of the Institute in December, shall be reported thereat as having resigned, unless it be unanimously voted by the Board, at its stated meeting in December, that such member has been absent for sufficient reason.

SEC. 7. *Standing Committees.*—The following Standing Committees, consisting of five members each, shall be appointed by the President and approved by the Board:

1. On Instruction. 2. On Election and Resignation of Members. 3. On Stocks and Finance. 4. On Publications. 5. On Exhibitions. 6. On Sectional Arrangements. 7. On Endowment. 8. Executive.

It shall be the duty of the Executive Committee to make to the Board such recommendation as it may deem advisable, but in the absence of specific delegation of authority, it shall have no power to act on behalf of the Board.

It shall be the duty of all the committees to keep regular minutes of their proceedings, and report monthly to the Board, and to report through the Committee on Stocks and Finance to the stated meeting of the Board in September, an estimate of moneys they require for the service of the ensuing year.

SEC. 8. *Professorships.*—The Board may, at its discretion, establish such Professorships as may seem advisable, and on such subjects as it may designate, to serve until the next succeeding first meeting after the annual meeting.

SEC. 9. *Order of Business.*—The order at the stated meetings shall be as follows:

1. Calling the roll.
2. Reading the minutes and acting thereon.
3. Report from Treasurer, and action on bills.
4. Report from Standing Committees, and action thereon
 - (a) On Instruction.
 - (b) On Election and Resignation of Members.
 - (c) On Stocks and Finance.
 - (d) On Publications.
 - (e) On Exhibitions.
 - (f) On Sectional Arrangements.
 - (g) On Endowment.
 - (h) Executive.
5. Reports from Special Committees and action thereon.
6. Deferred Business.
7. New Business.

SEC. 10. *Amendments.*—These By-Laws may be altered at any stated meeting of the Board, provided the alteration be approved by two-thirds of the members present.

AWARDS BY THE INSTITUTE

The following awards are made by The Franklin Institute :

- The Franklin Medal.**
- The Elliott Cresson Medal.**
- The Howard N. Potts Medal.**
- The Edward Longstreth Medal.**
- The Certificate of Merit.**
- The Boyden Premium.**

The making or recommending of these awards is, by resolution of the Institute, entrusted to its Committee on Science and the Arts, a Committee consisting of sixty members of the Institute. This Committee recommends to the Institute the award of the Franklin Medal to distinguished scientists or technologists; and investigates, upon application, and reports on any worthy invention, discovery of process, recommending the award, according to merit, of the Elliot Cresson Medal, the Howard N. Potts Medal, the Edward Longstreth Medal, or the Certificate of Merit.

The Franklin Medal (Gold Medal and Diploma).—This medal is awarded annually from the Franklin Medal Fund, founded January 1, 1914, by Samuel Insull, Esq., to those workers in physical science or technology, without regard to country, whose efforts, in the opinion of the Institute, acting through its Committee on Science and the Arts, have done most to advance a knowledge of physical science or its applications.

The Elliott Cresson Medal (Gold Medal and Diploma).—This medal is awarded for discovery or original research, adding to the sum of human knowledge, irrespective of commercial value; leading and practical utilizations of discovery; and invention, methods or products embodying substantial elements of leadership in their respective classes, or unusual skill or perfection in workmanship.

The Howard N. Potts Medal (Gold Medal and Diploma).—This medal is awarded for distinguished work in science or the arts; important development of previous basic discoveries; inventions or products of superior excellence or utilizing important principles; and for papers of especial merit that have been presented to the Institute and published in its JOURNAL.

The Edward Longstreth Medal (Silver Medal and Diploma).—This medal, with a money premium when the accumulated interest of the fund permits, is awarded for meritorious work in science or the arts. In the

event of an accumulation of the fund for medals beyond the sum of one hundred dollars, it is competent for the Committee on Science and the Arts to offer from such surplus a money premium for some special work on any mechanical or scientific subject that is considered of sufficient importance.

The Certificate of Merit.—A Certificate of Merit is awarded to persons adjudged worthy thereof for their inventions, discoveries or productions.

The Boyden Premium (Premium of \$1000).—To any resident of North America who shall determine by experiment whether all rays of light and other physical rays are or are not transmitted with the same velocity.

HISTORY OF THE MEDALS.

The Franklin Medal.—Samuel Insull, Esq., of Chicago, Illinois, writing under date of December 23, 1913, to the Board of Managers, stated that he had been informed it would be a source of gratification to them if the Institute had available, in addition to such medals already in its gifts, a medal to be known as The Franklin Medal, and to be awarded from time to time in recognition of the total contributions of individuals to science or to the applications of physical science to industry, rather than in recognition of any single invention or discovery, however important. He agreed to provide for the founding of this medal under the following general conditions:

1. That an amount not exceeding one thousand dollars should be furnished by him for procuring appropriate designs and dies for the medal and diploma.

2. That the medal should possess distinct artistic merit, and have on one side a medallion of Benjamin Franklin done from the Thomas Sully portrait in the possession of the Institute.

3. That the medal should be of gold and have an intrinsic value of about seventy-five dollars.

4. That the sum of five thousand dollars should be provided by him to be held in trust in perpetuity to be a foundation for this medal, and to be known as The Franklin Medal Fund (Founded January 1, 1914, by Samuel Insull, Esq.).

5. That the interest of this fund should be used from time to time in awarding The Franklin Medal to those workers in physical science or technology, without regard to country, whose efforts have, in the judgment of the Institute, done most to advance a knowledge of physical science or its applications.

6. That any excess of income from this fund, beyond such average annual sum as might be deemed necessary by the Institute for the number of medals it is considered best to award, might be used for premiums to accompany the medals.

Mr. Insull said he understood that the Institute would be glad to award, on the average, two Franklin Medals a year. Though this would leave little surplus, he inserted the sixth condition to prevent an undesirable accumulation of the fund.

'At the Stated Meeting of the Board of Managers, February 11, 1914, the above offer was accepted, and its acceptance was confirmed to Mr. Insull in the following resolutions:

"Resolved, That the Board of Managers of The Franklin Institute of the State of Pennsylvania accept the offer of Mr. Samuel Insull to establish The Franklin Medal, under the conditions named in his letter of December 23, 1913.

"Resolved further, that it is the sense of the Board of Managers of The Franklin Institute that Mr. Insull, in founding this Medal, has rendered a notable service in stimulating workers in Physical Science and Technology and has extended materially the useful activities of the Institute.

"Resolved further, that the thanks of the Board of Managers of the Institute be, and are hereby, extended to Mr. Insull for his generous and greatly appreciated action.

"Resolved further, that an engrossed copy of these resolutions be forwarded to Mr. Insull."

On March 24, 1914, Mr. Insull forwarded his check for six thousand dollars, and the following deed was duly executed and delivered:

KNOW ALL MEN BY THESE PRESENTS, That THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS, hereinafter named The Franklin Institute, for and in consideration of the sum of Six Thousand (\$6,000) Dollars to it in hand paid by Samuel Insull, Esq., the receipt whereof is hereby acknowledged, does hereby certify and declare that it holds and will use said sum of money for the following uses, intents and purposes, and upon the following perpetual trusts, that is to say:

1. To expend One Thousand (\$1,000) Dollars, or so much thereof as may be necessary, for the purpose of paying for the design of a medal, and the necessary dies and diploma plates for the purposes hereinafter set forth.

2. To invest and keep invested the balance of said sum, and from the income derived from such investments from time to time to strike off and award medals from said design to workers in physical science or technology, without regard to country, whose efforts, in the opinion of the Board of Managers of said The Franklin Institute, have done most to advance our knowledge of physical science or its application. Should the income derived from this fund be more than necessary for the purposes aforesaid, the said The Franklin Institute may, in its discretion, award so much of the surplus, as its Board of Managers deems wise, as premiums to accompany said medals.

3. The fund thus set apart shall be known as "The Franklin Medal Fund" (Founded January 1, 1914, by Samuel Insull, Esq.).

4. The medals to be awarded as aforesaid shall be of gold, shall have distinct artistic merit, shall be of the intrinsic value of about seventy-five (\$75) dollars, and shall have on one side thereof a medallion of Benjamin Franklin taken from his portrait by Thomas Sully, now in the possession of the said The Franklin Institute.

IN WITNESS WHEREOF, The said The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts has hereunto set its common or corporate seal, attested by the signatures of its President and Secretary, this 28th day of March, A.D. 1914.

WALTON CLARK,
President.

R. B. OWENS,
Secretary.

[SEAL]

The Elliott Cresson Medal.—Under date of February 18, 1848, Elliott Cresson, Esq., of Philadelphia, Pennsylvania, conveyed to the Trustees for The Franklin Institute one thousand dollars of the six per cent. convertible loan of the President, Managers and Company of the Schuylkill Navigation Company—to hold the said sum and the interest to accrue thereon, for the following uses and purposes:

1. The trustees to keep the principal invested as it now (1848) is until it is reimbursed by the said Company, and immediately after such reimbursement to reinvest the said principal of one thousand dollars in such securities, bearing interest, as may by law be designated for the investment of trust funds. And from time to time, as the said principal sum may be reimbursed, to reinvest the same in like manner.

2. To cause suitable dies to be prepared for striking the gold medal out of the first sufficient moneys received for interest on the said sum of one thousand dollars, the dies to bear the following devices and inscriptions: The obverse,—a medallion likeness of the said Elliott Cresson with inscription around the margin, "Elliott Cresson Medal, A.D. 1848." Reverse,—around the margin, "Awarded by The Franklin Institute of Pennsylvania." The centre to be filled by engraving the name of the party to whom awarded and the year in which the award is made.

3. After the said dies have been prepared, and paid for out of the money received for interest, the said Trustees to cause to be struck, from time to time, such number of gold medals as the interest received will pay for, and to deliver the same to the Treasurer of The Franklin Institute, to be by him transmitted to such persons or parties as the said Franklin Institute may have awarded the same; the said awards, however, to be in all instances made either for some discovery in the arts and

sciences, or for the invention or improvement of some useful machine, or for some new process or combination of materials in manufactures, or for ingenuity, skill or perfection in workmanship.

The Howard N. Potts Medal.—Howard N. Potts, Esq., of Philadelphia, Pennsylvania, died July 24, 1906, leaving a will in which he provided for the establishment of this medal as follows:

"I give and bequeath to The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts and its successors, the sum of one thousand dollars, without deduction for taxes or charges; in trust to invest the same and apply the income thereof or such part or portion of it as may be adequate for the purpose, from time to time, to the purchase of a gold medal, to be awarded in the name of the said Franklin Institute for distinguished work in science or the mechanic arts."

The Edward Longstreth Medal.—In the month of May, 1890, Edward Longstreth, Esq., of Philadelphia, Pennsylvania, retired member of The Baldwin Locomotive Works, deposited with The Franklin Institute in trust, a registered bond of the Baltimore Traction Company for the sum of one thousand dollars, for the founding and perpetuation of the Edward Longstreth Medal of Merit; the interest accruing from said principal sum to be used in procuring and awarding said medals for the encouragement of invention, and in recognition of meritorious work in science and the industrial arts; the said awards to be made by The Franklin Institute through its Committee on Science and the Arts, under such rules as said Committee may adopt.

This donor further presented to The Franklin Institute twelve silver medals and the die therefor designed and executed under the direction of a committee of the Institute with his approval.

On May 14, 1890, the Board of Managers of The Franklin Institute, by resolution, accepted on behalf of the Institute the gifts of the donor, and on September 17, 1890, the Institute, by resolution following, confirmed the acceptance:

"Resolved, That the Institute hereby confirms the action of the Board of Managers in accepting the gift of foundation of the Edward Longstreth Medal of Merit, and in expressing its grateful acknowledgments for the gift.

"Resolved, That the grant of the Edward Longstreth Medal, in accordance with the wishes of the donor, be entrusted to the Committee on Science and the Arts, subject to such conditions as the said Committee, with the approval of the Institute, may propose."

The obverse of the medal bears the effigy of the donor, and is inscribed around the margin, "The Edward Longstreth Medal of Merit, Founded

1890." On the reverse is inscribed around the margin, "Awarded by The Franklin Institute," and in the centre is engraved the name of the recipient with the date and object of award.

On March 19, 1913, Charles Longstreth, son of the above-named Edward Longstreth, deposited with The Franklin Institute the further sum of one thousand dollars to be added to the original fund to be kept with it in trust in perpetuity, the interest to be used as is the interest of the original fund.

The Certificate of Merit.—At the stated meeting of the Institute, held on June 21, 1882, the following resolution was adopted:

"Resolved, That the Committee on Science and the Arts of The Franklin Institute is hereby authorized to award, and issue to persons by said Committee adjudged worthy, a Certificate of Merit for their inventions, discoveries or productions, which certificate shall read as follows:

'The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, awards to _____ this Certificate of Merit. This award is made pursuant to the recommendation of the Committee on Science and the Arts.

Report No. _____ Approved, _____ 19 _____

_____ *President.*

[SEAL]

_____ *Secretary.*

Chairman of the Committee on Science and the Arts.'"

The Boyden Premium.—On March 23, 1859, Uriah A. Boyden, Esq., of Boston, Massachusetts, deposited with The Franklin Institute the sum of one thousand dollars to be awarded as a premium to any resident of North America who shall determine by experiment whether all rays of light, and other physical rays, are or are not transmitted with the same velocity.

The problem has been more specifically defined by the Board of Managers, as follows:

"Whether or not all rays in the spectrum known at the time the offer was made, namely, March 23, 1859, and comprised between the lowest frequency known thermal rays in the infra-red, and the highest frequency known rays in the ultra-violet, which in the opinion of the Committee lie between the approximate frequencies of 2×10^{14} double vibrations per second in the infra-red and 8×10^{14} in the ultra-violet, travel through free space with the same velocity."

An award, made during the year 1907, covered the solution of the problem so far as the transmission of the visible and ultra-violet rays is concerned. It has been directed by the Board of Managers that the balance of the fund be retained, to be awarded to such person as shall demonstrate whether or not the infra-red rays are or are not transmitted with the same velocity as the other rays.

REGULATIONS OF THE COMMITTEE ON SCIENCE AND THE ARTS

ARTICLE I.—*Investigations.*

SECTION 1. The Committee shall investigate, by sub-committee or otherwise, any subject referred to it by the Institute or by any of its sections; and upon a majority vote of the members present at any stated meeting, it may investigate any subject presented on motion of a member or by application as herein provided.

SEC. 2. Secret processes of compounds will not be considered by the Committee; nor will the treatment of materials by any substance be considered, unless the composition used and the method of treatment are fully disclosed.

SEC. 3. An applicant for investigation of a subject will be furnished by the Secretary with a copy of the regulations governing investigations.

SEC. 4. An application for investigation shall be made in writing on a blank, substantially like "Form A" below, which may be obtained from the Secretary. This application shall be addressed to the Secretary, who will, upon receipt refer it to the Sub-Committee on New Subjects and Preliminary Examination; this sub-committee shall recommend to the Committee its acceptance or rejection, upon which the Secretary shall notify the applicant accordingly.

SEC. 5. It shall not be competent for any member of the Committee on Science and the Arts to be an applicant for any of the awards in the gift, or under the recommendation, of the said Committee, unless the subject for award be referred to the Committee by a vote of the Institute.

ARTICLE II.—*Meetings of the Committee.*

SECTION 1. The Committee shall hold stated meetings at 8 o'clock P.M. on the first Wednesday of each month, excepting July and August.

SEC. 2. Special meetings may be called by the Chairman, and shall be called by him upon the written request of five members of the Committee.

SEC. 3. At all meetings of the Committee nine members shall constitute a quorum for transacting general business, but for final action upon a report conferring or recommending an award or for amending the rules of the Committee, a quorum shall consist of not less than fifteen members.

SEC. 4. At its stated meeting the Committee shall proceed in the following

Order of Business:

1. Calling the roll.
2. Reading of the minutes of preceding meeting.
3. Reading of correspondence.

4. Approval of bills.
5. Report of Sub-Committee on New Subjects and Preliminary Examination.
6. Reports of standing and special sub-committees.
7. Consideration of reports for final action.
8. Reports of sub-committees on investigation, first reading.
9. Deferred business.
10. New business.
11. Adjournment.

SEC. 5. Members shall not be entitled to the floor more than twice on any question without the consent of the Committee.

SEC. 6. There shall be no debate on points of order except on an appeal from the decision of the Chairman, or on a question referred by him to the Committee. In such cases no member shall have the floor more than once without the consent of the Committee.

ARTICLE III.—*Chairman.*

SECTION 1. Nominations for a Chairman to serve for one year shall be made at the stated meeting of the Committee in February, and the election shall be by ballot at the same meeting, when the person receiving the highest number of votes shall be declared elected. He shall immediately assume office and shall perform his duties until his successor is installed. He shall not be eligible for election in two successive terms.

SEC. 2. The Chairman shall appoint the members of all sub-committees unless otherwise ordered, and may serve *ex officio* on all sub-committees except those charged with investigations.

SEC. 3. The election of a member as Chairman shall be held to vacate his membership of any and all sub-committees on investigation on which he may be serving, except if he has the report of such Committee prepared or in preparation, in which case he shall complete his work, but when such report is presented for consideration, he shall call on another member to preside while the subject is under discussion.

SEC. 4. The Chairman shall submit to the stated meetings of the Board of Managers in October, December, February, April, and June of each year, a report of the number of investigations pending before the Committee, the number disposed of since the last report, with the action taken or award made in each case, and the number and nature of new investigations undertaken since the last report, and such other information as to the work of the Committee as the Board of Managers may require. He shall also report to the stated meetings of the Institute such recent action of the Committee as he may deem of interest.

ARTICLE IV.—*Standing Sub-Committees.*

SECTION 1. There shall be appointed each February by the Chairman a sub-committee of not less than five members of the Committee, to be styled the "Sub-Committee on New Subjects and Preliminary Examination." The

duties of this sub-committee shall be to keep a general observation of progress made in science and the arts and to report to the Committee subjects adjudged worthy of investigation; to co-operate with the Secretary in keeping the work of the Committee properly before the public, and to recommend at each regular meeting the acceptance or otherwise of all applications for investigation. This sub-committee shall meet at least once prior to each regular meeting of the Committee.

SEC. 2. There shall be appointed each April by the Chairman from the membership with the consent and approval of the Committee, a sub-committee styled the "Sub-Committee on Literature." It shall be the duty of this sub-committee to examine carefully all papers that have been presented to the Institute and published in its JOURNAL during the current year, and to report to the Committee not later than the following April meeting which of these papers deserve the award of, viz.:

1. *The Howard N. Potts Medal;*
2. *The Certificate of Merit.*

The Institute, through the Committee, may award said medals to the authors of papers so recommended, except that it shall not so award more than one Potts Medal in any one year.

The Sub-Committee on Literature shall also consider any publication or treatise devoted to science or the mechanic arts, submitted by the Committee, and if in its judgment said work appears to be of unusual merit it may recommend that its author be awarded the Potts Medal, provided that such medal shall not be so awarded more than once in any one year.

Advertisement of these awards shall not be required.

SEC. 3. There shall be appointed annually by the Chairman from the membership a sub-committee styled the "Sub-Committee on Awarding the Franklin Medal," the duty of which shall be to make recommendations of the award of this medal under the provisions of the deed of gift.

ARTICLE V.—*Sub-Committees on Investigation of Applications.*

SECTION 1. Upon the acceptance of an application for investigation, a sub-committee shall be appointed by the Chairman to conduct the investigation.

SEC. 2. Sub-committees shall be appointed from the membership of the Committee, but they may include a minority of other persons whose expert services are desired in the examination.

SEC. 3. When the personnel of a sub-committee on investigation is finally determined, a notice shall be sent to each member thereof giving the names of the members of the sub-committee and setting forth the regulations governing investigations.

SEC. 4. No person shall be a member of a sub-committee on investigation who is interested in the issue.

SEC. 5. After a subject has been assigned to a sub-committee for investigation it shall not be withdrawn without the consent of the Committee

SEC. 6. When the Secretary has obtained the necessary information from the applicant, he shall notify the sub-committee, who shall then proceed with the investigation.

SEC. 7. Correspondence between the sub-committee and the applicant must be carried on through the office of the Secretary, in order that the official records shall be complete.

SEC. 8. Sub-committees shall whenever possible make direct examination and tests of the subject under investigation, and shall not accept tests, data or information furnished by others without first satisfying themselves as to the accuracy thereof. They shall in no case recommend an award solely on the basis of tests, data or information furnished by parties in any way interested in the subject of the award. When data submitted by persons not members of the sub-committee are included in the latter's report, it shall be so stated.

SEC. 9. Sub-committees must ascertain that articles, processes, products, etc., examined are genuine samples of the subject under investigation.

SEC. 10. Each sub-committee on investigation shall report its progress to the Committee at intervals of not more than two consecutive stated meetings; and any sub-committee failing so to report for four consecutive stated meetings may be discharged from further consideration of the subject at the discretion of the Chairman, who shall then appoint a new sub-committee to continue the investigation.

SEC. 11. Any member of a sub-committee on investigation failing to discharge his duties may be replaced by another member at the discretion of the Chairman.

SEC. 12. Sub-committees may request applicants to furnish drawings, diagrams or other exhibits for the purpose of investigations and for the records of the Committee.

SEC. 13. When it is found that the subject under investigation has become involved in litigation, the sub-committee shall defer further action until the litigation is terminated, or the Committee decides that the sub-committee may proceed.

ARTICLE VI.—*Sub-Committee Meetings.*

SECTION 1. A quorum for the transaction of business at any meeting of a sub-committee, properly called, shall consist of the one or more members present.

SEC. 2. No applicant or other person interested in the issue of an investigation shall be present at a meeting of a sub-committee or of the Committee except at the invitation of the sub-committee charged with the investigation.

ARTICLE VII.—*Sub-Committees' Reports.*

SECTION 1. Reports of progress and final reports of sub-committees shall be made to the Committee in writing. Final reports shall begin and end substantially as indicated in Form B.

SEC. 2. When a sub-committee on investigation deems the subject upon which it reports worthy of an award of the Elliott Cresson Medal, the Howard N. Potts Medal, the Edward Longstreth Medal, or the Certificate of Merit, it shall include in its report a recommendation to that effect; and such recommendation may be adopted by a majority vote of the Committee, but shall not be changed except by a vote of two-thirds of the members present.

SEC. 3. A report of a sub-committee on investigation, before its acceptance by the Committee, may be edited by the Secretary of the Institute in conjunction with the chairman of the sub-committee, but without materially changing its meaning or effect. The Secretary and chairman may be assisted in this work by the Publications Committee of the Institute, or by an editing committee appointed by the Chairman of the Committee.

SEC. 4. A report of a sub-committee on investigation, before its acceptance by the Committee, shall be signed by a majority of the members of the sub-committee charged with the investigation.

SEC. 5. Any member or members of a sub-committee may file a minority report at least three days prior to the meeting at which the majority report is to be presented.

SEC. 6. No member of a sub-committee shall be permitted to sign a report without having personally examined the subject under investigation, or taken part in its discussion at a meeting of the sub-committee.

SEC. 7. Reports of sub-committees on investigation shall be accompanied by such drawings, diagrams or other exhibits as will serve to elucidate the subject.

SEC. 8. All exhibits pertaining to reports shall be numbered, marked for identification, and signed by the Secretary of the Institute in substantially the following form, and the seal of the Institute shall be impressed thereon:—

Exhibit No. ———, pertaining to report of the Committee on Science and the Arts No. ———

Secretary.

SEC. 9. Reports must be in the Secretary's hands at least one week previous to the stated meeting at which they are to be presented.

SEC. 10. After the report of a sub-committee on investigation has passed its first reading before the Committee, a copy of it may be furnished the applicant, who may make any explanation or objections, in writing, addressed to the Chairman of the Committee; but such writing must be received not later than the next stated meeting of the Committee.

SEC. 11. The report of a sub-committee on investigation may be discussed and amended at the meeting of the Committee at which it is first presented, but shall be laid over for a second reading and final action until the next stated meeting; except where no recommendation of an award is made in the report, when it may, by a majority vote, be finally disposed of after first reading.

SEC. 12. Final action on a report of a sub-committee on investigation recommending an award shall not be taken unless at least one member of the sub-committee who signed the report is present.

ARTICLE VIII.—*Notices of Recommendations.*

SECTION 1. In the case of investigations made upon application, it shall be the duty of the Secretary to certify to applicants the recommendation of the sub-committee within ten days after this recommendation is adopted by the Committee.

ARTICLE IX.—*Reconsideration.*

SECTION 1. Upon the adoption of a report of a sub-committee a motion for reconsideration may not be made before the stated meeting following. If such a motion is then made and accepted, a vote of two-thirds of a quorum for final action shall be required to change the report as previously adopted.

SEC. 2. A second investigation of a subject shall not be ordered except on a vote of two-thirds of the members present at a stated meeting.

ARTICLE X.—*Advertisement of Recommendations.*

SECTION 1. Upon the adoption, by the Committee on Science and the Arts, of a report of a sub-committee on investigation setting forth that a discovery, invention, improvement or manufacture is worthy of an award of the Elliott Cresson Medal, publication shall be made in three successive issues of the JOURNAL of The Franklin Institute, stating that at the expiration of three months from the date of the first publication, the person making such discovery, invention, improvement or manufacture shall be entitled to receive the award of the said medal, unless within that time satisfactory evidence shall have been submitted to the Committee on Science and the Arts of the want of originality or merit, in the supposed discovery, invention, improvement, or manufacture.

SEC. 2. Upon the adoption by the Committee on Science and the Arts of a report of a sub-committee on investigation setting forth that distinguished work in science or the arts is worthy of an award of the Howard N. Potts Medal, publication shall be made in three successive issues of the JOURNAL of The Franklin Institute, stating that at the expiration of three months from the date of the first publication, the person who has done such work shall be entitled to receive the award of the said medal, unless within that time satisfactory evidence shall have been submitted to the Committee on Science and the Arts of the want of originality or merit in the supposed distinguished work in science and the arts.

SEC. 3. The adoption by the Committee on Science and the Arts of a report of a sub-committee recommending an award of the Franklin Medal shall be conclusive without advertisement.

SEC. 4. The adoption by the Committee on Science and the Arts of a report of a sub-committee recommending an award of the Edward Longstreth Medal shall be conclusive without advertisement.

SEC. 5. The adoption by the Committee on Science and the Arts of a report of a sub-committee recommending an award of the Certificate of Merit shall be conclusive without advertisement.

ARTICLE XI.—*Protests.*

SECTION 1. Protests against recommendations advertised by publication in the JOURNAL must be received within three months of the date of first publication. Such protests shall be presented to the Committee at its next stated meeting following date of receipt, and shall be affirmed only by a vote of two-thirds of a quorum for final action, in which case a re-investigation shall be made.

ARTICLE XII.—*Institute Reports.*

SECTION 1. Reports issued by the Institute shall begin and end substantially as in Form C below. They shall be written upon an official form provided by the Institute.

SEC. 2. Reports when issued shall state that they are the action of The Franklin Institute by its Committee on Science and the Arts. They shall be attested by the President and the Secretary of the Institute and by the Chairman of the Committee, and shall be impressed with the seal of the Institute; and they may also bear the names of the members who signed the sub-committee's report.

SEC. 3. It shall be the duty of the Secretary to furnish applicants for investigation with a copy of the Institute's Report.

ARTICLE XIII.—*Amendments to Regulations.*

SECTION 1. Proposals to amend these regulations shall be presented to the Committee in writing, signed by at least two members. They may be considered when presented, but shall not be acted upon until the next stated meeting after presentation, and shall then be adopted if agreed to by two-thirds of the required quorum.

SEC. 2. Notice of proposed amendments shall be sent to each member on the programme for the meeting at which they may be acted upon.

A special committee, appointed for the purpose of preparing a memorandum covering the practice of the committee in the matter of recommending the different awards available to the Institute, presented a detailed report at the Stated Meeting on September 1, 1920, of which the following are the conclusions:

Since much latitude is allowed by the terms of the several medal bequests and no rules for the making of Institute awards conflict with the purpose and intent of the donors can be made, it is obviously not the part of wisdom to attempt too much in the way of definition but your Committee is of the opinion that future awards might be made with the following general understanding:

That the Certificate of Merit be awarded for meritorious inventions in physical processes, and JOURNAL contributions of substantial merit but not of such merit as would warrant the award of a medal.

2. That the Edward Longstreth Medal be awarded for invention of high order and for particularly meritorious improvements and developments in machines and mechanical processes.

3. That the Howard N. Potts Medal be awarded in recognition of important discoveries in physical science and JOURNAL contributions of the first rank.

4. That the Elliott Cresson Medal be awarded in recognition of inventions of signal value and fundamentally important in the arts and industries.

5. That the Franklin Medal continue to be awarded to those whose efforts have contributed most to a knowledge of physical science and its applications.

REPORT FORMS OF COMMITTEE ON SCIENCE AND THE ARTS

FORM A

(Application for Investigation)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

In the matter of your application to The Franklin Institute for a consideration of your invention or discovery entitled

..... the following data are requested for the information of the Committee on Science and the Arts:

1. What is the specific purpose of the invention?
2. What is the condition of the prior art in this regard?
3. What improvement is claimed to be effected by the invention?
4. How is the improvement effected?
5. What patents, if any, have been issued for this invention?
6. What citations, if any, were made in this regard by the Patent Office before allowance of patent claims?
7. Is the invention now in actual use?
8. If so, since when?
9. Where may it be seen in operation?
10. Are you prepared to submit drawings of the apparatus or device?
11. Are you prepared to submit a model of the apparatus or device?
12. If the invention is a composition of matter, are you prepared to submit specimens of the ingredients and of the compound sufficient for the purpose of experiments?
13. If the invention is a chemical process, are you prepared to give a demonstration of the same?

IMPORTANT TO APPLICANT

This application carefully filled in and other available matters descriptive of the invention or process together with two copies of each of the United States patents issued to applicant must be returned promptly to the Secretary of The Franklin Institute, 15 South Seventh Street, Philadelphia, Pa.

(A copy of Form A, above, may be obtained from the Secretary of the Institute and must be filled in, signed and promptly returned by an applicant for an examination of and a report upon an invention or discovery.)

FORM B
(Sub-committee Report Form)
THE FRANKLIN INSTITUTE
OF THE
STATE OF PENNSYLVANIA
FOR THE
PROMOTION OF THE MECHANIC ARTS

S. & A. Case No.

REPORT OF SUB-COMMITTEE, dated

Investigating

TO THE COMMITTEE ON SCIENCE AND THE ARTS:

Your sub-committee appointed to investigate the above subject report as follows:

.....

In consideration of the {
discovery
excellence of construction
ingenuity and novelty
or

of your sub-committee recommends
the award of to of

Respectfully submitted,

..... *Chairman.*

.....

.....

.....

Adopted at the Stated Meeting of 19

FORM C

(Institute Report Forms)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

HALL OF THE INSTITUTE,

Philadelphia,

S. & A. Case No.

The Franklin Institute of the State of Pennsylvania, acting through its
Committee on Science and the Arts, investigating
..... reports as follows:

In consideration of the {
discovery
excellence of construction
ingenuity and novelty
or

of the Institute awards the

to of

[SEAL]

..... *President.*..... *Secretary.*

Countersigned

Chairman of the Committee on Science and the Arts.

PRESIDENT'S REPORT AND REPORTS OF THE COMMITTEES OF THE INSTITUTE AND THE COMMITTEES OF ITS BOARD OF MANAGERS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1921.

REPORT OF THE PRESIDENT

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1921.

To the Members of the Franklin Institute:

This writing is the report which your Board of Managers has instructed me to make to you of the affairs of the Institute for the Institute year ending September 30, 1921.

The work of the Institute was carried on through the year successfully as the Management think, and as you may learn in detail from a reading of the reports of the several committees of the Board and of the Institute as they will appear in the 1922 Year Book. As is customary in the Managers' report, we quote briefly from the Committee reports, with such comment as seems useful.

The Committee on Exhibitions (Mr. Franklin, Chairman) reports on the present status of the Sesqui-Centennial Exhibition as it effects The Franklin Institute. This report does not call for any specific comment here.

The Committee on Museum (Mr. Outerbridge, Chairman) reports the additions to the Museum of models and apparatus of great historic interest, among them the air pump of Dr. Joseph Priestley, presented by Mr. Coleman Sellers, Jr.; and odometer made and used by Isaiah Lukens, one of the early Vice-presidents of the Institute, presented by Mr. Henry R. Towne; a printing telegraph, the invention of George H. Phelps, presented by the Pennsylvania Hospital; and an Oertling balance, with weights, presented by Dr. Harry F. Keller.

Most of our models are now so crowded on the shelves of the Institute that they are practically not available to the student, the inventor and the mechanic. We have reason to believe that we will soon be able to store and properly display our many valuable models and pieces of apparatus of historic value in a building owned and operated by the Institute.

The report of the Committee on Sectional Arrangements (Dr. Keller, Chairman) tells in detail of the lectures—nineteen in number—delivered during the year before the various sections of the Institute. This report is interesting to read, but offers little opportunity for presentation in brief.

The Committee on Meetings (Dr. Alleman, Chairman) reports the lectures delivered before the Institute. Eight stated meetings were held during the year. This report, like that of the Committee on Sectional Arrangements, is interesting reading, dealing with one of our very important functions, but not susceptible of summarization.

YEAR BOOK OF

The Committee on Publications (Mr. Rosengarten, Chairman) reports, among other interesting data, the publication of the book "Physics of the Air," by W. M. F. Pettersen, of the United States Weather Bureau, author. Of this publication 400 copies have been sold, and the demand is still strong. It is a well-recognized authority and of great value to meteorologists and to the general public. It is a volume also of great interest to the layman. The Committee on Publications also reports a slight, but encouraging, decrease in the circulation of the *JOURNAL* and of the Year Book.

The Committee on Library (Dr. Creighton, Chairman) reports additions to the collection of books, volumes and pamphlets, an increase of 393 titles over the gain of the preceding year. The great sugar library bequeathed to the Institute by John D. Rockefeller, Jr., about 25,000 volumes and pamphlets—is still in temporary storage in the present warehouse. As indicated elsewhere in this report, we have the prospect of soon being able to store this valuable collection of books in a new building owned by The Franklin Institute.

From the report of the Committee on Instruction (Mr. Paul, Chairman)—covering the ninety-seventh year of our School of Mechanic Arts—we learn that the classes tell off a little, but very little, in numbers from the unusually high enrollment of the previous year. Again we found it necessary to open the school for six evenings a week instead of four—our practice prior to 1919—in order comfortably to accommodate the students. The number of students graduated in the class exercises in April—being sixty-nine—is greater than in any other year in the history of the School.

The Committee on Science and the Arts (Mr. Masland, Chairman) reports that 107 cases disposed of during the year and nineteen awards made. This is an unusually large record of disposition of cases and of awards. The report refers to the publication in the 1921 Year Book of a list of all the awards made on recommendation of the Committee since its establishment in 1834. The total of the awards made is 892.

The Committee on Endowment (Mr. Sellers, Chairman) gives some important data relative to the Bartol Bequest, and very interesting information of another bequest so far not reported to you. Mr. George Theodore Roberts, who died in March, 1921, made The Franklin Institute one of the residuary legatees of his large estate, his daughter having a life interest in the property. Mr. Sellers has been advised that the Institute's interest as one of the residuary legatees probably amounts to \$40,000.

The Committee on Stock and Finance (Mr. Forstall, Chairman) reports a very sound financial condition, although for the immediate present our operating expense exceeds our operating revenue. This is a condition anticipated by your Board when we told you a year ago of the then increase in our balance of assets over liabilities, and that at the end of the year, for the first time in memory the Institute would be out of debt, except as between departments. Our work costs more than our regular income affords, but less than our regular income plus the occasional bequests applicable to operating expenses, as over a period of years. In the confidence that this will be a continuing condition we have gone on with our work, spending what was necessary to its efficient conduct,

So we propose to go on with it as long as we have available funds, or bank credit or salable property—never to the extent of imperilling creditors' interests—or of using trust funds other than as designated by their donors—but otherwise to the limit of possibility. Such a course has had your approval in the past, as we hope it has your approval in the present.

The Committee on Election and Resignation of Members (Mr. Lesley, Chairman) reports a total membership of 1386, an increase of six members for the year. This increase—though small—is very welcome, being the first in several years. If the Institute depended for its financial support upon the membership dues received it would do little work indeed. Why we have less than six hundred resident members in this great industrial city is a question we have not been able to answer. None of our efforts to increase our membership has had more than slight success. Of course our location is against us. When dreams come true and we are on the Parkway, perhaps our membership will increase.

The Committee to carry into effect the intent and purposes of the Henry W. Bartol Bequest was duly appointed, as instructed by your resolution of November 17, 1920. The members of the Committee are:

Mr. Charles Day, Chairman;
Dr. Joseph S. Ames of Johns Hopkins University;
Mr. Coleman Sellers, Jr.;
Dr. Arthur L. Day, of the Carnegie Institution of Washington;
Mr. C. C. Tutwiler;

with the President and the Secretary of the Institute as *ex officio* members.

The Committee, with the concurrent approval of the Franklin Fund and Building Committee (Mr. Howson, Chairman), anticipates that this year we will be able to begin construction of a laboratory, to be owned by The Franklin Institute, and to be occupied in part by the research work to which the Estate of Henry W. Bartol is dedicated.

The principal of the Bartol Bequest available as of December 31, 1921, is approximately \$1,300,000, and there is an accumulated interest fund as of that date of about \$250,000. The settlements made effective with the contestants of the will will result ultimately in an addition to this fund of about \$600,000. It will be some years before this fund of \$600,000 will be available.

The Committee therefore finds the Bartol Bequest with an accumulated income of \$250,000 and the expectation of a continuing income of from \$75,000 to \$80,000 per annum, to later increase to probably \$100,000 per annum.

It is proposed, with the approval of the Franklin Fund and Building Committee and of the Board of Managers of the Institute, and as soon as the necessary legal and other procedures may be observed, to erect a laboratory on three of the twelve lots owned by the Institute on Nineteenth Street between Cherry and Race Streets. It is expected the laboratory will cost approximately \$250,000, of which \$100,000 will be provided from the accumulated income from the Bartol Research Fund, and \$150,000 by the Institute through its Franklin Fund and Building Committee. This laboratory, which will be of a character to harmonize with the other buildings of The Franklin Institute group which we

expect will ultimately occupy the other lots owned by the Institute at this location, will be sufficient to house the Bartol research work and all of the chemical and physical laboratory work of the Committee on Science and the Arts and of all other departments of The Franklin Institute.

The equipment, except for certain standard apparatus that is immediately indicated as necessary, is to be installed gradually as the necessities of the research work in hand indicate. The contribution of the Bartol Research Fund to the cost of the laboratory building is measured by what we estimate it would cost the Committee on the Bartol Bequest to erect a building suitable for its work at a less expensive site. The building being owned by The Franklin Institute, the Bartol Research Bequest will be given a right to use the laboratory in its work for a period that may be definitely fixed or may be unlimited, according as we shall decide later.

The management of the work of the Bartol Research Committee will be in the hands of Dr. R. B. Owens, Director, reporting to the Committee, and with such research professors and fellows as it may be found necessary or important to engage. The sub-committee of Dr. Owens, Chairman; Dr. Joseph S. Ames, and Dr. Arthur L. Day, has been appointed to engage the necessary staff.

The Institute is to be congratulated upon this prospect of soon starting work on a building that will house a portion of its activities, and as we confidently anticipate, will be but the first step toward the construction of a group of buildings, now to be discussed herein.

Your Board thinks it wise at this time, and in this connection to advise you of its hopes and ambitions for the future housing and conduct of the work of the Institute.

The laboratory necessary to the proper housing of the Bartol research work, and of the chemical and physical work of the Committee on Science and the Arts, and of other departments of the Institute, has had reference herein. Our hope is that ultimately this laboratory will be one of a group of three buildings. We look forward to the date of the realization of our hopes and expectations, to see a building at the corner of Nineteenth Street and the Parkway, exteriorly worthy of a place among the noble structures then to be its neighbors and bearing a dignity worthy of the great name it will bear, and interiorly sufficient and suitable to the proper housing and conduct of all the Institute's work and equipment, except that the laboratory and museum are to be otherwise sheltered. The third building of the little group devoted to the promotion of the mechanic arts, when our hopes find fulfilment, will be so-called "Scientific and Technical Museum." In it will be properly arranged and connected for illustration and for operation, the many important models and facsimile apparatus now possessed by the Institute, and the multitude of such other things of interest to a follower of the mechanic arts as we have assurance will come to us when we are prepared properly to care for them. We believe that such a museum has no example in America. The American student, historian, mechanic or inventor, desiring to trace the development of an art through the study of concrete examples, must now journey to Europe to find what we will be able to present to him when our proposed museum is in operation.

Such a group of buildings so equipped will be without counterpart in America. The value of the opportunity therein offered to the student the scientist and the mechanic cannot be exaggerated in statement. To provide and equip these buildings is upon the program your Board now presents to you—the membership of the Institute.

Does this appear an unduly ambitious program? We think it is not, and we ask you, members of the Institute, when considering it to remember that the Institute's wagon has ever been hitched to a star, and that, so drawn, it has come nearly to the hundredth year post on its road, maintaining still, as we believe, the virility and enthusiasm of youth and as capable as ever of vision and of accomplishment.

You will note that however ambitious our program may appear, it comprehends no departure from the scheme of usefulness laid out by our founders. With greater opportunity, more funds, and the example and experience of nearly a hundred years of service for our guidance, we of this generation may reasonably hope for ourselves and our successors to extend the benefits of the Institute's work to an ever widening circle—the interest being still confined to the Promotion of the Mechanic Arts—the vision being still that which inspired the founders and the generations of workers who have brought the Institute down the century to our day and custody. We remember with pride what of public good these men accomplished—generally, if not always—with very limited financial resources—their one unlimited resource the spirit of devotion. May we not confidently expect our successors in membership to have this spirit of devotion in equal measure, and, with the experience and example of our predecessors to inspire and guide them, to produce results, as expressed in usefulness to the public, somewhat commensurate with the financial resources and equipment we leave to them? We of your Board of Managers believe we may so confidently anticipate greater results to come with more nearly adequate funds and equipment, and so believing, we submit our program. In the absence of objection we shall regard it as having your approval. We do not doubt that the Institute will ultimately reach the goal this program sets for it. When—no one can say. It is probable that the first step—the laboratory building—will be begun this year, and that the research work of the Bartol Foundation will be fully under way in it at the celebration of our centennary in 1924.

We now own all the land useful in carrying out our full program, except for one lot, and without this lot we can carry out our program, with somewhat reduced convenience of operation. Our funds dedicated to buildings will nearly be exhausted by the laboratory cost. So from the completion of our laboratory our building program must await the acquisition of more funds. The main building equipped and occupied, will cost approximately one million dollars. The next step in our program is the erection and equipment of the scientific and technical museum, costing probably two hundred and fifty thousand dollars. The order of erection of these two buildings—the main building and the museum—might be reversed and the museum be the first to follow the laboratory.

Since we will have greater operating expenses in the new buildings, and since we cannot greatly increase our regular income, we think we should not venture

REPORT OF THE COMMITTEE ON LIBRARY

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1921.

[ABSTRACT.]

To the President and Members of The Franklin Institute:

The Committee on Library respectfully submits the statement of activities in the library during the year ending September 30, 1921.

The additions to the library were as follows:

| Source | Bound Volumes | Unbound Volumes | Pamphlets |
|------------------------|---------------|-----------------|------------|
| By Gift | 206 | 192 | 1644 |
| Binding | 390 | | |
| Journal | 52 | 11 | |
| Purchase: | | | |
| Books and Periodicals | | | |
| Account | 4 | | |
| Jayne Fund | 26 | 2 | |
| Lea Fund | 29 | 5 | 6 |
| Memorial Library Fund | 28 | 4 | |
| Miscellaneous Expense | | | |
| Account | 1 | 1 | 1 |
| Moore Fund | 28 | 103 | 3 |
| Morris Fund | 47 | 5 | 3 |
| Periodicals Completion | | | |
| Fund | 1 | 4 | |
| Potts Fund | 9 | 2 | |
| Ware Fund | 66 | 28 | |
| | <hr/> 887 | <hr/> 357 | <hr/> 1657 |

Total additions for the year2901

An increase of 393 titles over the previous year.

The Committee had at its disposal \$1525.00 appropriated by the Board of Managers and \$3359.27, the income from the various trust funds.

The expenditures for the year were \$1131.06 for binding, \$2720.04 for books and subscriptions to magazine and other periodical publications, and \$229.26 for general expenses.

Donors:

Gifts of books, pamphlets and magazines in large quantities or of special value were received from Messrs. Hugo Bilgram, Francis T. Chambers, J. A. P. Crisfield, William Forsyth, F. L. Garrison, Max Levy, Lawrence T. Paul; Doctors Carl Hering, Harry F. Keller, Henry Leffmann, the estate of Frederick J. M. Oldach, the Shoemaker-Satterthwaite Bridge Company and the United States Metallic Packing Company.

The contents of the library on September 30, 1921 were as follows:

| | |
|----------------------------------|--------|
| Volumes, bound and unbound | 75,912 |
| Pamphlets | 18,254 |
| Maps and Charts | 2,292 |
| Photographs | 1,349 |

Binding:

During the year the following work was done by the binder:

| | |
|---|-----------|
| Recent volumes of periodicals | 350 |
| Recent volumes of foreign chemical periodicals charged to chemical periodical binding fund | 30 |
| Old volumes, bound and rebound | 88 |
| | <hr/> 468 |

Magazine and Periodical Publications:

7116 copies of the Journal were used for exchange purposes.

Seven new exchanges were added to the mailing list and fourteen were removed.

Six new subscriptions were ordered and six were discontinued.

The total number of exchanges on September 30th was 586. The subscriptions totaled 130 and the number of gift subscriptions was 73, making the total periodical publications currently received, 789.

Evening Hours:

The library was open on meeting nights until ten o'clock, in all, thirty-five evenings.

Respectfully submitted,

H. JERMAIN CREIGHTON,

Chairman.

PHILADELPHIA, January 11, 1922.

REPORT OF THE COMMITTEE ON MUSEUM

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1921.

To the President and Members of The Franklin Institute:

The following historic models and apparatus have been added to the Institute's collections during the past year:

Air pump of Dr. Joseph Priestley. Presented by Mr. Coleman Sellers, Jr. (An account of Dr. Priestley and his work and a history of this interesting apparatus was prepared by Mr. Sellers and appears in December, 1920 issue of the JOURNAL, Vol. 190, page 877.)

Odometer made by Isaiah Lukens, one of the two first elected vice-presidents of the Institute and Chairman of the Institute's Committee on Inventions. Presented by Mr. Henry R. Towne, of New York City. (A sketch of the life of Isaiah Lukens by Mr. Coleman Sellers, Jr., and a

description of the odometer by Mr. Towne, appeared in the JOURNAL of the Institute for August, 1921, Vol. 192, page 239.)

Printing telegraph for sending and receiving messages. Invention of George M. Phelps, Brooklyn, New York; U. S. Patent No. 91,662, June 22, 1869. Presented by the Pennsylvania Hospital, Dr. Owen Copp, Physician-in-Chief and Administrator.

Oertling Balance, complete with set of weights. The first accurate scales for the chemical laboratory, constructed about 1840. Presented by Dr. Harry F. Keller.

Respectfully submitted,

ALEX. E. OUTERBRIDGE, JR.,

Chairman.

PHILADELPHIA, January 11, 1922.

REPORT OF THE COMMITTEE ON MEETINGS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1921.

To the President and Members of The Franklin Institute:

Eight stated meetings were held during the year ending September 30, 1921. These were held on the third Wednesday of each month, from October to May inclusive, at the hour of eight o'clock, with the exception of that of May 18, which was held at three-thirty o'clock in the afternoon.

The following is a list of dates, speakers with titles and synopses of their communications:

October 20, 1920: Joseph S. Ames, Ph.D., LL.D., Director of Physical Laboratory, The Johns Hopkins University, Baltimore, Maryland, member of the Institute, presented a paper on "Einstein's Principle of Relativity and Its Bearing Upon Physics."

"Einstein has introduced into the interpretation of the phenomena of nature, as observed on the earth, an entirely new concept and an entirely new mode of approach." The lecture gave an account of his method and attention to some of the conclusions obtained by it and to their verification by experiment and observation. Emphasis was laid on the fact that Einstein has developed a method and not a theory. The paper was printed in full in the January, 1921 issue of the JOURNAL.

At this meeting Mr. Coleman Sellers, Jr., presented to the Institute an air pump formerly the property of Dr. Joseph Priestley. An account of this historical apparatus appeared in the December, 1920 number of the JOURNAL.

The Howard N. Potts medal was presented to Mr. Edward Payson Bullard, Jr., for his Mult-Au-Matic Machine.

November 17, 1920: The paper of the evening was presented by Dr. Charles A. Culver of the Canadian Independent Telephone Company, Ltd., Toronto, Canada, on "Guided Wave Telephony."

The fundamental principles and limitations involved in high frequency

multiplex operation were considered and a brief historical resume of the invention and early development of this new means of communication given. Current practical engineering methods were discussed, including special applications to hydro-electric power line operation and train dispatching. The subject of attenuation and required power were also treated. Lantern slides were used to illustrate the subject and a working demonstration was given of communication by means of guided wave telephony superimposed upon a physical telephone circuit. Published in the *JOURNAL*, March, 1921.

The Elliott Cresson Medal was presented to Mr. W. R. L. Emmet for his notable contributions to the art of ship propulsion.

The Edward Longstreth Medal of Merit was presented to Messrs. G. L. Kothny and Robert Suzek for their Radiojet air pump.

December 15, 1920: Mr. W. C. White, E.E., Research Laboratory, General Electric Company, Schenectady, New York, presented the paper of the evening entitled "Some Operating Characteristics of Electron Tubes."

"Electron tubes or simply vacum tubes, as they are most often called, are coming into very general use for quite a wide variety of purposes. Their flexible characteristics and variety of properties also make them very useful in laboratories and for engineering tests and developments. However, in the use of these tubes for special purposes, difficulties are frequently encountered which are due to properties of the tube which are not commonly known or understood." The lecture described a number of these more unusual characteristics, the effects of which, however, are often commonly met with in practice and give experimental difficulty or prevent the correct interpretation of results. The subject was illustrated by lantern slides. The paper was published in the *JOURNAL* for April, 1921.

January 19, 1921. Annual Meeting of the Institute.

Mr. John W. Lieb, Mechanical Engineer, Vice-president of the New York Edison Company, New York City, New York, member of the Institute, read a paper entitled, "Leonardo da Vinci, Philosopher and Engineer."

The lecture presented a review of the activities of Leonardo da Vinci, as a Philosopher and Engineer, with illustrations and abstracts from his note-books, some of them translated by the lecturer. The review covered Leonardo's work in Military, Civil, Mechanical and Hydraulic Engineering, Aviation, Geology, Anatomy, Optics and many other branches of science, literature and the arts. The lecture revealed Leonardo as one of the greatest intellects of all time, assigning to him an even higher place in philosophy, science and mechanics than he already holds in the history of the graphic arts. The subject was illustrated by numerous lantern photographs of manuscripts and drawings from da Vinci's note-books. The paper appeared in the June and July, 1921 issues of the *JOURNAL*.

February 16, 1921: Colonel Marston Taylor Bogart, A.B., Ph.B., LL.D., Professor of Organic Chemistry, Columbia University, New York City, New York, presented the paper of the evening entitled, "The Bearing of a Synthetic Dye Industry upon Our National Welfare."

"Outside of those individuals who happen to be directly concerned financially, the average male citizen is probably not greatly interested in the availability or non-availability of a host of dyes capable of producing all the hues of the rainbow. In fact, he might not even regard it as a national calamity if he had to wear a white tie instead of a colored one. But when he fully understands and appreciates that his own life, the lives of those dear to him, and the very existence of his country depend upon this same industry, the subject is likely to assume a totally different aspect." After a brief outline of the synthetic dye industry, there was described in detail how its by-products and intermediates are utilized for the production of important medicinals, explosives, incendiaries, war gases, photo chemicals, inks, perfumes, artificial resins, etc. In his fight against disease and death, the physician has no more potent allies than the products which owe their origin to the dye industry, and in war for national existence, no more powerful weapons have been developed than those of chemical warfare. A dye factory has been called a "potential arsenal." The impetus and encouragement which it has given to chemical research, and the effect of the same upon the teaching of chemistry in our educational institutions, were considered briefly also. The lecture was illustrated by samples of many of the compounds mentioned and by the actual preparation upon the lecture table of some of them. Published in the JOURNAL for April, 1921.

March 16, 1921: The paper of the evening entitled "Recent Developments in the Manufacture of Sulphuric Acid" was presented by Andrew M. Fairlie, A.B., Chemical Engineer of Atlanta, Georgia.

This lecture was limited in its scope to the nitration processes for the manufacture of sulphuric acid. The features discussed included some of the developments in design and construction of plant, as well as developments in operation, which have become noteworthy during and since the war. Acid-proof masonry towers, new varieties of tower-packing material, the Mills-Packard water cooled acid chamber, other recent proposals for removing the heat of the chamber reactions by means of water-cooling, and nitration by means of oxidized ammonia gas, are some of the features which were briefly described. The subject was illustrated by lantern slides.

April 20, 1921: Dr. Charles E. Lucke, Professor of Mechanical Engineering, Columbia University, New York City, New York, member of the Institute, presented a communication on "The Motorship: Its Economic Position with Reference to the Oil Fired Turbine Steamer."

"The future of the American merchant marine will be determined by the success of our cargo-carrying ships measured by transportation costs in competition with foreign vessels. The motorship has been highly developed and extensively built in Europe, but not in America. The geared steam turbine steamer has been and now is the main reliance in this country, and is in competition at sea with the European motorship. Each has at present a proper but different economic position, which will be determined by analysis of weights, fuel consumptions and costs. The machinery of both classes of vessels is still undergoing changes, and the relative competitive position of these two

The school opened on September 13, 1920, and during the year four hundred and seventy individual students were enrolled. This was twenty less than the unusually large enrollment of the previous year, but it was necessary to keep the school open five evenings each week instead of four as was previously done in order to accommodate the students comfortably. The largest classes formed during the year were those in First-Year Mechanical Drawing and First-Year Mathematics.

The high grade of work done by the students and their regular attendance indicate that the school has completed one of the most satisfactory years in its history. During the first term, one hundred and six students had a perfect attendance record and forty-nine made an average of ninety per cent. or over. During the second term, one hundred and three students had a perfect attendance record and fifty-nine made an average of ninety per cent. or over.

The Faculty for the year was as follows:

Louis C. Robinson, Director of the School.

Arthur J. Stretton, The Baldwin Locomotive Works, Mechanical Drawing.

I. P. Pedrick, William Sellers & Company, Inc., Mechanical Drawing.

G. W. H. Fawkes, of the University of Pennsylvania Faculty, Mechanical Drawing.

Howard W. Howitz, The Baldwin Locomotive Works, Mechanical Drawing.

Karl E. Klabe, The Baldwin Locomotive Works, Mechanical Drawing and Mathematics.

Clement Remington, Associated with Horace Trumbower, Architect, Architectural Drawing.

John C. Bechtel, of the Germantown High School Faculty, Mathematics.

Frederick C. Miller, of the Germantown High School Faculty, Mathematics.

Harry H. Fox, of the Norristown High School Faculty, Mathematics.

Herbert H. Blizzard, Geo. W. Kendrick 3rd & Company, Mathematics.

W. Earl Neilson, Student at University of Pennsylvania, Mathematics.

Bartram A. Owen, of the University of Pennsylvania Faculty, Mechanics and Structural Design.

B. W. Taylor, of the University of Pennsylvania Faculty, Machine Design.

Joseph W. Thompson, New York Shipbuilding Company, Practical Naval Architecture.

H. Earl Barrett, William Cramp & Sons Ship and Engine Building Company, Theoretical Naval Architecture.

R. E. Brown, New York Shipbuilding Company, Theoretical Naval Architecture.

Albert R. Ware, New York Shipbuilding Company, Practical Naval Architecture.

James G. Morgan, New York Shipbuilding Company, Practical Naval Architecture.

expect will ultimately occupy the other lots owned by the Institute at this location, will be sufficient to house the Bartol research work and all of the chemical and physical laboratory work of the Committee on Science and the Arts and of all other departments of The Franklin Institute.

The equipment, except for certain standard apparatus that is immediately indicated as necessary, is to be installed gradually as the necessities of the research work in hand indicate. The contribution of the Bartol Research Fund to the cost of the laboratory building is measured by what we estimate it would cost the Committee on the Bartol Bequest to erect a building suitable for its work at a less expensive site. The building being owned by The Franklin Institute, the Bartol Research Bequest will be given a right to use the laboratory in its work for a period that may be definitely fixed or may be unlimited, according as we shall decide later.

The management of the work of the Bartol Research Committee will be in the hands of Dr. R. B. Owens, Director, reporting to the Committee, and with such research professors and fellows as it may be found necessary or important to engage. The sub-committee of Dr. Owens, Chairman; Dr. Joseph S. Ames, and Dr. Arthur L. Day, has been appointed to engage the necessary staff.

The Institute is to be congratulated upon this prospect of soon starting work on a building that will house a portion of its activities, and as we confidently anticipate, will be but the first step toward the construction of a group of buildings, now to be discussed herein.

Your Board thinks it wise at this time, and in this connection to advise you of its hopes and ambitions for the future housing and conduct of the work of the Institute.

The laboratory necessary to the proper housing of the Bartol research work, and of the chemical and physical work of the Committee on Science and the Arts, and of other departments of the Institute, has had reference herein. Our hope is that ultimately this laboratory will be one of a group of three buildings. We look forward to the date of the realization of our hopes and expectations, to see a building at the corner of Nineteenth Street and the Parkway, exteriorly worthy of a place among the noble structures then to be its neighbors and bearing a dignity worthy of the great name it will bear, and interiorly sufficient and suitable to the proper housing and conduct of all the Institute's work and equipment, except that the laboratory and museum are to be otherwise sheltered. The third building of the little group devoted to the promotion of the mechanic arts, when our hopes find fulfilment, will be so-called "Scientific and Technical Museum." In it will be properly arranged and connected for illustration and for operation, the many important models and facsimile apparatus now possessed by the Institute, and the multitude of such other things of interest to a follower of the mechanic arts as we have assurance will come to us when we are prepared properly to care for them. We believe that such a museum has no example in America. The American student, historian, mechanician or inventor, desiring to trace the development of an art through the study of concrete examples, must now journey to Europe to find what we will be able to present to him when our proposed museum is in operation.

Such a group of buildings so equipped will be without counterpart in America. The value of the opportunity therein offered to the student the scientist and the mechanic cannot be exaggerated in statement. To provide and equip these buildings is upon the program your Board now presents to you—the membership of the Institute.

Does this appear an unduly ambitious program? We think it is not, and we ask you, members of the Institute, when considering it to remember that the Institute's wagon has ever been hitched to a star, and that, so drawn, it has come nearly to the hundredth year post on its road, maintaining still, as we believe, the virility and enthusiasm of youth and as capable as ever of vision and of accomplishment.

You will note that however ambitious our program may appear, it comprehends no departure from the scheme of usefulness laid out by our founders. With greater opportunity, more funds, and the example and experience of nearly a hundred years of service for our guidance, we of this generation may reasonably hope for ourselves and our successors to extend the benefits of the Institute's work to an ever widening circle—the interest being still confined to the Promotion of the Mechanic Arts—the vision being still that which inspired the founders and the generations of workers who have brought the Institute down the century to our day and custody. We remember with pride what of public good these men accomplished—generally, if not always—with very limited financial resources—their one unlimited resource the spirit of devotion. May we not confidently expect our successors in membership to have this spirit of devotion in equal measure, and, with the experience and example of our predecessors to inspire and guide them, to produce results, as expressed in usefulness to the public, somewhat commensurate with the financial resources and equipment we leave to them? We of your Board of Managers believe we may so confidently anticipate greater results to come with more nearly adequate funds and equipment, and so believing, we submit our program. In the absence of objection we shall regard it as having your approval. We do not doubt that the Institute will ultimately reach the goal this program sets for it. When—no one can say. It is probable that the first step—the laboratory building—will be begun this year, and that the research work of the Bartol Foundation will be fully under way in it at the celebration of our centenary in 1924.

We now own all the land useful in carrying out our full program, except for one lot, and without this lot we can carry out our program, with somewhat reduced convenience of operation. Our funds dedicated to buildings will nearly be exhausted by the laboratory cost. So from the completion of our laboratory our building program must await the acquisition of more funds. The main building equipped and occupied, will cost approximately one million dollars. The next step in our program is the erection and equipment of the scientific and technical museum, costing probably two hundred and fifty thousand dollars. The order of erection of these two buildings—the main building and the museum—might be reversed and the museum be the first to follow the laboratory.

Since we will have greater operating expenses in the new buildings, and since we cannot greatly increase our regular income, we think we should not venture

on the next step of our program—the erection of the larger building—until we have a larger regular income dedicated to operating expenses. We think the Institute would not be justified in undertaking the full program now before us without an added endowment of a million dollars.

Thus the roughly estimated cost of completing our full program is two and a quarter million dollars. We believe that in the example of the founders of the Institute we may find the guide to the realization of our ambition. Efficient work in the public interest, the full utilization of what property has been confided to us, will in the future, as in the past, meet the approval of people seeking to dedicate some part of their accumulated wealth to the promotion of the mechanic arts. Always a part of our program is the efficient and economic application of our financial resources to such ends. We do not doubt that living to this part of our program in the future, as we have striven to live to it in the past, will bring such increase in financial resources as will make possible the full realization of the ambitions your Managers have herein discussed.

Respectfully submitted,

WALTON CLARK,
President.

PHILADELPHIA, January 18, 1922.

REPORT OF THE COMMITTEE ON LIBRARY

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1921.

[ABSTRACT.]

To the President and Members of The Franklin Institute:

The Committee on Library respectfully submits the statement of activities in the library during the year ending September 30, 1921.

The additions to the library were as follows:

| Source | Bound Volumes | Unbound Volumes | Pamphlets |
|------------------------|---------------|-----------------|------------|
| By Gift | 206 | 192 | 1644 |
| Binding | 390 | | |
| Journal | 52 | 11 | |
| Purchase: | | | |
| Books and Periodicals | | | |
| Account | 4 | | |
| Jayne Fund | 26 | 2 | |
| Lea Fund | 29 | 5 | 6 |
| Memorial Library Fund | 28 | 4 | |
| Miscellaneous Expense | | | |
| Account | 1 | 1 | 1 |
| Moore Fund | 28 | 103 | 3 |
| Morris Fund | 47 | 5 | 3 |
| Periodicals Completion | | | |
| Fund | 1 | 4 | |
| Potts Fund | 9 | 2 | |
| Ware Fund | 66 | 28 | |
| | <hr/> 887 | <hr/> 357 | <hr/> 1657 |

Total additions for the year2901

An increase of 393 titles over the previous year.

The Committee had at its disposal \$1525.00 appropriated by the Board of Managers and \$3359.27, the income from the various trust funds.

The expenditures for the year were \$1131.06 for binding, \$2720.04 for books and subscriptions to magazine and other periodical publications, and \$229.26 for general expenses.

Donors:

Gifts of books, pamphlets and magazines in large quantities or of special value were received from Messrs. Hugo Bilgram, Francis T. Chambers, J. A. P. Crisfield, William Forsyth, F. L. Garrison, Max Levy, Lawrence T. Paul; Doctors Carl Hering, Harry F. Keller, Henry Leffmann, the estate of Frederick J. M. Oldach, the Shoemaker-Satterthwaite Bridge Company and the United States Metallic Packing Company.

The contents of the library on September 30, 1921 were as follows:

| | |
|----------------------------------|--------|
| Volumes, bound and unbound | 75,912 |
| Pamphlets | 18,254 |
| Maps and Charts | 2,292 |
| Photographs | 1,349 |

Binding:

During the year the following work was done by the binder:

| | |
|---|-------|
| Recent volumes of periodicals | 350 |
| Recent volumes of foreign chemical periodicals charged to chemical periodical binding fund | 30 |
| Old volumes, bound and rebound | 88 |
| | <hr/> |
| | 468 |

Magazine and Periodical Publications:

7116 copies of the Journal were used for exchange purposes.

Seven new exchanges were added to the mailing list and fourteen were removed.

Six new subscriptions were ordered and six were discontinued.

The total number of exchanges on September 30th was 586. The subscriptions totaled 130 and the number of gift subscriptions was 73, making the total periodical publications currently received, 789.

Evening Hours:

The library was open on meeting nights until ten o'clock, in all, thirty-five evenings.

Respectfully submitted,

H. JERMAIN CREIGHTON,
Chairman.

PHILADELPHIA, January 11, 1922.

REPORT OF THE COMMITTEE ON MUSEUM

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1921.

To the President and Members of The Franklin Institute:

The following historic models and apparatus have been added to the Institute's collections during the past year:

Air pump of Dr. Joseph Priestley. Presented by Mr. Coleman Sellers, Jr. (An account of Dr. Priestley and his work and a history of this interesting apparatus was prepared by Mr. Sellers and appears in December, 1920 issue of the JOURNAL, Vol. 190, page 877.)

Odometer made by Isaiah Lukens, one of the two first elected vice-presidents of the Institute and Chairman of the Institute's Committee on Inventions. Presented by Mr. Henry R. Towne, of New York City. (A sketch of the life of Isaiah Lukens by Mr. Coleman Sellers, Jr., and a

description of the odometer by Mr. Towne, appeared in the JOURNAL of the Institute for August, 1921, Vol. 192, page 239.)

Printing telegraph for sending and receiving messages. Invention of George M. Phelps, Brooklyn, New York; U. S. Patent No. 91,662, June 22, 1869. Presented by the Pennsylvania Hospital, Dr. Owen Copp, Physician-in-Chief and Administrator.

Oertling Balance, complete with set of weights. The first accurate scales for the chemical laboratory, constructed about 1840. Presented by Dr. Harry F. Keller.

Respectfully submitted,

ALEX. E. OUTERBRIDGE, JR.,

Chairman.

PHILADELPHIA, January 11, 1922.

REPORT OF THE COMMITTEE ON MEETINGS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1921.

To the President and Members of The Franklin Institute:

Eight stated meetings were held during the year ending September 30, 1921. These were held on the third Wednesday of each month, from October to May inclusive, at the hour of eight o'clock, with the exception of that of May 18, which was held at three-thirty o'clock in the afternoon.

The following is a list of dates, speakers with titles and synopses of their communications:

October 20, 1920: Joseph S. Ames, Ph.D., LL.D., Director of Physical Laboratory, The Johns Hopkins University, Baltimore, Maryland, member of the Institute, presented a paper on "Einstein's Principle of Relativity and Its Bearing Upon Physics."

"Einstein has introduced into the interpretation of the phenomena of nature, as observed on the earth, an entirely new concept and an entirely new mode of approach." The lecture gave an account of his method and attention to some of the conclusions obtained by it and to their verification by experiment and observation. Emphasis was laid on the fact that Einstein has developed a method and not a theory. The paper was printed in full in the January, 1921 issue of the JOURNAL.

At this meeting Mr. Coleman Sellers, Jr., presented to the Institute an air pump formerly the property of Dr. Joseph Priestley. An account of this historical apparatus appeared in the December, 1920 number of the JOURNAL.

The Howard N. Potts medal was presented to Mr. Edward Payson Bullard, Jr., for his Mult-Au-Matic Machine.

November 17, 1920: The paper of the evening was presented by Dr. Charles A. Culver of the Canadian Independent Telephone Company, Ltd., Toronto, Canada, on "Guided Wave Telephony."

The fundamental principles and limitations involved in high frequency

multiplex operation were considered and a brief historical resume of the invention and early development of this new means of communication given. Current practical engineering methods were discussed, including special applications to hydro-electric power line operation and train dispatching. The subject of attenuation and required power were also treated. Lantern slides were used to illustrate the subject and a working demonstration was given of communication by means of guided wave telephony superimposed upon a physical telephone circuit. Published in the *JOURNAL*, March, 1921.

The Elliott Cresson Medal was presented to Mr. W. R. L. Emmet for his notable contributions to the art of ship propulsion.

The Edward Longstreth Medal of Merit was presented to Messrs. G. L. Kothny and Robert Suczek for their Radiojet air pump.

December 15, 1920: Mr. W. C. White, E.E., Research Laboratory, General Electric Company, Schenectady, New York, presented the paper of the evening entitled "Some Operating Characteristics of Electron Tubes."

"Electron tubes or simply vacum tubes, as they are most often called, are coming into very general use for quite a wide variety of purposes. Their flexible characteristics and variety of properties also make them very useful in laboratories and for engineering tests and developments. However, in the use of these tubes for special purposes, difficulties are frequently encountered which are due to properties of the tube which are not commonly known or understood." The lecture described a number of these more unusual characteristics, the effects of which, however, are often commonly met with in practice and give experimental difficulty or prevent the correct interpretation of results. The subject was illustrated by lantern slides. The paper was published in the *JOURNAL* for April, 1921.

January 19, 1921. Annual Meeting of the Institute.

Mr. John W. Lieb, Mechanical Engineer, Vice-president of the New York Edison Company, New York City, New York, member of the Institute, read a paper entitled, "Leonardo da Vinci, Philosopher and Engineer."

The lecture presented a review of the activities of Leonardo da Vinci, as a Philosopher and Engineer, with illustrations and abstracts from his note-books, some of them translated by the lecturer. The review covered Leonardo's work in Military, Civil, Mechanical and Hydraulic Engineering, Aviation, Geology, Anatomy, Optics and many other branches of science, literature and the arts. The lecture revealed Leonardo as one of the greatest intellects of all time, assigning to him an even higher place in philosophy, science and mechanics than he already holds in the history of the graphic arts. The subject was illustrated by numerous lantern photographs of manuscripts and drawings from da Vinci's note-books. The paper appeared in the June and July, 1921 issues of the *JOURNAL*.

February 16, 1921: Colonel Marston Taylor Bogart, A.B., Ph.B., LL.D., Professor of Organic Chemistry, Columbia University, New York City, New York, presented the paper of the evening entitled, "The Bearing of a Synthetic Dye Industry upon Our National Welfare."

"Outside of those individuals who happen to be directly concerned financially, the average male citizen is probably not greatly interested in the availability or non-availability of a host of dyes capable of producing all the hues of the rainbow. In fact, he might not even regard it as a national calamity if he had to wear a white tie instead of a colored one. But when he fully understands and appreciates that his own life, the lives of those dear to him, and the very existence of his country depend upon this same industry, the subject is likely to assume a totally different aspect." After a brief outline of the synthetic dye industry, there was described in detail how its by-products and intermediates are utilized for the production of important medicinals, explosives, incendiaries, war gases, photo chemicals, inks, perfumes, artificial resins, etc. In his fight against disease and death, the physician has no more potent allies than the products which owe their origin to the dye industry, and in war for national existence, no more powerful weapons have been developed than those of chemical warfare. A dye factory has been called a "potential arsenal." The impetus and encouragement which it has given to chemical research, and the effect of the same upon the teaching of chemistry in our educational institutions, were considered briefly also. The lecture was illustrated by samples of many of the compounds mentioned and by the actual preparation upon the lecture table of some of them. Published in the *JOURNAL* for April, 1921.

March 16, 1921: The paper of the evening entitled "Recent Developments in the Manufacture of Sulphuric Acid" was presented by Andrew M. Fairlie, A.B., Chemical Engineer of Atlanta, Georgia.

This lecture was limited in its scope to the nitration processes for the manufacture of sulphuric acid. The features discussed included some of the developments in design and construction of plant, as well as developments in operation, which have become noteworthy during and since the war. Acid-proof masonry towers, new varieties of tower-packing material, the Mills-Packard water cooled acid chamber, other recent proposals for removing the heat of the chamber reactions by means of water-cooling, and nitration by means of oxidized ammonia gas, are some of the features which were briefly described. The subject was illustrated by lantern slides.

April 20, 1921: Dr. Charles E. Lucke, Professor of Mechanical Engineering, Columbia University, New York City, New York, member of the Institute, presented a communication on "The Motorship: Its Economic Position with Reference to the Oil Fired Turbine Steamer."

"The future of the American merchant marine will be determined by the success of our cargo-carrying ships measured by transportation costs in competition with foreign vessels. The motorship has been highly developed and extensively built in Europe, but not in America. The geared steam turbine steamer has been and now is the main reliance in this country, and is in competition at sea with the European motorship. Each has at present a proper but different economic position, which will be determined by analysis of weights, fuel consumptions and costs. The machinery of both classes of vessels is still undergoing changes, and the relative competitive position of these two

types of vessel in the future will be determined largely by these changes, and a second analysis will estimate the effects of the changes. There will probably be always a place for both types of ship, the problem being to define the position in which each is best, by analysis of characteristics, and to estimate the comparative numbers of each required for handling world trade." The subject was illustrated by lantern slides. This paper appeared in the July and August, 1921 numbers of the JOURNAL.

At this meeting Mr. Henry R. Towne of New York presented to the Institute an odometer made by Isaiah Lukens, one of the two first elected Vice-presidents of the Institute and first Chairman of the Institute's Committee on Inventions. An account of this instrument appears in the JOURNAL for August, 1921.

May 18, 1921: 3:30 o'clock P. M. Certificate of Honorary Membership was presented to General John J. Pershing, General of the Armies of the United States.

The Franklin Medal, accompanying certificate, and Certificate of Honorary Membership were presented to His Excellency M. Jusserand, French Ambassador, for Professor Charles Fabry of the University of Paris, Paris, France.

The Franklin Medal, accompanying certificate, and Certificate of Honorary Membership were presented to Dr. Frank J. Sprague of New York City.

Dr. Joseph S. Ames of The Johns Hopkins University, Baltimore, Maryland read Professor Charles Fabry's paper on "Studies in the Field of Light Radiation."

Dr. Frank J. Sprague read his paper "Electric Traction: A Review."

A detailed account of the meeting appears in the JOURNAL for September, 1921 as well as the papers by Dr. Fabry and Dr. Sprague.

The attendance at these meetings totaled 1244.

Manuscripts of most of the papers have been received and those not yet published will appear in early issues of the JOURNAL.

Respectfully submitted,

GELLERT ALLEMAN,

Chairman.

PHILADELPHIA, January 11, 1922.

REPORT OF THE COMMITTEE ON INSTRUCTION

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1921.

To the Board of Managers of The Franklin Institute:

The courses offered in the ninety-seventh year of The Franklin Institute School of Mechanic Arts, commencing in September, 1920, were substantially the same as those given the preceding year. Classes were formed in Mechanical Drawing, Architectural Drawing and Design, Freehand Drawing and Water Color, Shop Arithmetic and Algebra, Plane Geometry and Trigonometry, Applied Mechanics and Strength of Materials, Machine Design, Structural Design, and Theoretical and Practical Naval Architecture.

The school opened on September 13, 1920, and during the year four hundred and seventy individual students were enrolled. This was twenty less than the unusually large enrollment of the previous year, but it was necessary to keep the school open five evenings each week instead of four as was previously done in order to accommodate the students comfortably. The largest classes formed during the year were those in First-Year Mechanical Drawing and First-Year Mathematics.

The high grade of work done by the students and their regular attendance indicate that the school has completed one of the most satisfactory years in its history. During the first term, one hundred and six students had a perfect attendance record and forty-nine made an average of ninety per cent. or over. During the second term, one hundred and three students had a perfect attendance record and fifty-nine made an average of ninety per cent. or over.

The Faculty for the year was as follows:

Louis C. Robinson, Director of the School.

Arthur J. Stretton, The Baldwin Locomotive Works, Mechanical Drawing.

I. P. Pedrick, William Sellers & Company, Inc., Mechanical Drawing.

G. W. H. Fawkes, of the University of Pennsylvania Faculty, Mechanical Drawing.

Howard W. Howitz, The Baldwin Locomotive Works, Mechanical Drawing.

Karl E. Klabe, The Baldwin Locomotive Works, Mechanical Drawing and Mathematics.

Clement Remington, Associated with Horace Trumbower, Architect, Architectural Drawing.

John C. Bechtel, of the Germantown High School Faculty, Mathematics.

Frederick C. Miller, of the Germantown High School Faculty, Mathematics.

Harry H. Fox, of the Norristown High School Faculty, Mathematics.

Herbert H. Blizzard, Geo. W. Kendrick 3rd & Company, Mathematics.

W. Earl Neilson, Student at University of Pennsylvania, Mathematics.

Bartram A. Owen, of the University of Pennsylvania Faculty, Mechanics and Structural Design.

B. W. Taylor, of the University of Pennsylvania Faculty, Machine Design.

Joseph W. Thompson, New York Shipbuilding Company, Practical Naval Architecture.

H. Earl Barrett, William Cramp & Sons Ship and Engine Building Company, Theoretical Naval Architecture.

R. E. Brown, New York Shipbuilding Company, Theoretical Naval Architecture.

Albert R. Ware, New York Shipbuilding Company, Practical Naval Architecture.

James G. Morgan, New York Shipbuilding Company, Practical Naval Architecture.

During the year, students and alumni of the school visited the following places of engineering interest:

Point Breeze Gas Works of the United Gas Improvement Company, Philadelphia, Pa.

Delaware County Power Station of The Philadelphia Electric Company, Chester, Pa.

The Atlantic Refining Company, Philadelphia, Pa.

Bridesburg Plant of The Ajax Metal Company, Philadelphia, Pa.

American Engineering Company, Philadelphia, Pa.

Bement-Miles Works, Philadelphia, Pa.

Hess-Bright Manufacturing Company, Philadelphia, Pa.

Leeds & Northrup Company, Philadelphia, Pa.

Link Belt Company, Philadelphia, Pa.

Newton Machine Tool Works, Philadelphia, Pa.

Warren Webster & Company, Camden, N. J.

Beach Street Power Station of The Philadelphia Rapid Transit Company, Philadelphia, Pa.

The New York Shipbuilding Company, Camden, N. J.

In every case the attendance was good and much interest was shown by those present.

The graduating exercises were held in the Hall of the Institute on the evening of April 15, 1921. In the absence of Dr. Walton Clark, President of the Institute, Mr. Coleman Sellers, Jr., Vice-President, presided. The speaker of the evening was the Honorable Edwin S. Stuart, Ex-Governor of Pennsylvania. The Alumni Association was represented by Mr. James G. Morgan. Sixty-nine students, the largest number in any one year of the history of the school, were graduated: four in Mechanical Drawing, eight in Architectural Drawing, one in Freehand Drawing and Water Color, thirty-nine in Mathematics, eleven in Mechanics, and six in Naval Architecture.

The following scholarships were awarded:

Six B. H. Bartol Scholarships,

Six Isaac B. Thorn Scholarships.

The prize provided by the late John H. Siegler, Esq., Germantown, Philadelphia, Pa., in his will dated February 21st, 1918, was awarded jointly to a student in Naval Architecture and a student in Mathematics.

Following is an abstract of the will containing the conditions of the award:

"I give and bequeath unto The Franklin Institute the sum of one thousand dollars (\$1000), to be invested and kept invested, and the income arising therefrom and thereout to be given annually as a prize to the student deserving the highest commendation for earnest work and high standard of scholarship in regular attendance upon the sessions during the school year last past."

The student of greatest merit in the Department of Mathematics was awarded a prize donated by Mr. J. B. McCall, President of the Philadelphia Electric

Company. A prize donated by Mr. Wilfred Lewis, President of the Tabor Manufacturing Company, was awarded the student of greatest merit in the Department of Mechanics. Two students in the Department of Drawing were awarded prizes; to the student who in the opinion of the Committee on Instruction made the best and most complete set of Mechanical Drawings was awarded a prize donated by Mr. S. M. Vauclain, President of The Baldwin Locomotive Works, and to the student who in the opinion of the Committee on Instruction made the best and most complete set of Architectural Drawings was awarded a prize donated by Mr. Robert W. Lesley, Past-President of the Portland Cement Association and a member of the Board of Managers of the Institute. A set of drawing instruments, donated by the New York Ship-building Company, was awarded to the student of greatest merit in the Department of Naval Architecture. Six students received awards provided by the Alumni Association of The Franklin Institute School of Mechanics Arts, and twenty-four graduates, having a perfect attendance record, were awarded free membership for one year in the association. Certificates of Honorable Mention were awarded to seventy-four students for excellent work during the year.

The graduates were invited to the annual smoker and dinner of the Alumni Association, held on the evening of Saturday, April 16, 1921. At the dinner 68 covers were laid and addresses were made by Mr. Charles W. Masland, representative of the Board of Managers, and by Mr. Walter G. Jones of Woodbury, N. J.

During the summer three thousand copies of the School Calendar and one thousand posters were so distributed as to reach the greatest number of possible students.

Respectfully submitted,

LAWRENCE T. PAUL,
Chairman.

PHILADELPHIA, January 11, 1922.

REPORT OF THE COMMITTEE ON ELECTION AND RESIGNATION OF MEMBERS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1921.

To the Board of Managers of The Franklin Institute:

During the fiscal year ending September 30th, 1921 seventy-five new members were enrolled in all classes of membership; resignations were received and accepted from twenty-four members; and deaths of twenty-nine members were recorded.

The detail as to elections, resignations, and deaths for the three years ending September 30th, 1921 is as follows:

ELECTIONS:

| | 1918-19 | 1919-20 | 1920-21 |
|-----------------------------|---------|---------|---------|
| Resident Members | 21 | 32 | 30 |
| Non-Resident Members | 28 | 19 | 35 |
| Associate Members | 4 | 11 | 5 |
| Honorary Members | 10 | 2 | 3 |
| Corresponding Members | 0 | 3 | 0 |
| Life Members | 3 | 0 | 2 |
| Second Class Stock | 0 | 0 | 0 |
| | — | — | — |
| | 66 | 67 | 75 |

RESIGNATIONS:

| | | | |
|----------------------------|----|----|----|
| Resident Members | 17 | 19 | 9 |
| Non-Resident Members | 10 | 14 | 14 |
| Associate Members | 0 | 0 | 1 |
| Second Class Stock | 0 | 0 | 0 |
| | — | — | — |
| | 27 | 33 | 24 |

DEATHS:

| | | | |
|----------------------------|----|----|----|
| Resident Members | 8 | 6 | 8 |
| Non-Resident Members | 12 | 8 | 6 |
| Life Members | 11 | 8 | 14 |
| Honorary Members | 1 | 1 | 0 |
| Associate Members | 2 | 0 | 0 |
| Second Class Stock | 1 | 0 | 1 |
| | — | — | — |
| | 35 | 23 | 29 |

SUMMARY:

| | | | |
|--------------------------------------|----|----|----|
| Elections | 66 | 67 | 75 |
| Resignations | 27 | 33 | 24 |
| Dropped for non-payment of dues | 10 | 27 | 16 |
| Deaths | 35 | 23 | 29 |
| Net increase in membership | 6 | | |

Membership of the Institute by Classes, September 30th, 1921.

| | |
|----------------------------------|-------|
| Resident Members | 516 |
| Non-Resident Members | 584 |
| Life Members | 204 |
| Honorary Members | 24 |
| Associate Members | 31 |
| Second Class Stock Members | 24 |
| Corresponding Members | 3 |
| Total | 1,386 |

It will be noted that while the year ending September 30th, 1920 showed a decrease in membership of 16, the current year has been more favorable, a net increase in membership of 6 being shown.

Respectfully submitted,

R. W. LESLEY,
Chairman.

PHILADELPHIA, January 11, 1922.

REPORT OF THE COMMITTEE ON STOCKS AND FINANCE

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1921.

To the Board of Managers of The Franklin Institute:

The Committee presents the following financial statement:

PROPERTY AND FUNDS.

| | | |
|--|----------------|----------------------|
| Building and land, 13-17 South Seventh Street..... | \$60,000.00 | |
| Library | 100,000.00 | \$160,000.00 |
| | Principal | Unexpended Income |
| Funds held by Board of Trustees..... | \$626,953.66 | \$2,240.09 |
| Funds held by Board of Managers..... | 151.72 | |
| Franklin Institute Building Fund | 522,984.65 | |
| Elliott Cresson Medal Fund..... | 3,000.00 | 715.51 |
| Franklin Fund and Building Committee.. | 14,971.17 | |
| Total Funds | \$1,168,061.20 | \$2,955.60 |
| Grand Total | | \$1,171,016.80 |

LIABILITIES.

| | |
|-----------------------------|-------------|
| Certificates of Stock | \$29,240.00 |
| Bills Payable | 11,000.00 |
| Vouchers Payable | 4,975.25 |
| Unearned Income | 3,958.10 |
| | \$49,173.35 |

INCOME AND EXPENSES APPLICABLE TO YEAR ENDED SEPTEMBER 30, 1921.

Income:

| | | |
|--------------------------|------------|-------------|
| Dues: Resident | \$7,320.00 | |
| Non-resident | 2,962.50 | |
| Second Class Stock | 288.00 | |
| Associate | 145.00 | \$10,715.50 |

| | | |
|---|-------------|---------------------|
| Initiation Fees | | 160.00 |
| Harriet Blanchard Legacy | | 55,551.78 |
| H. Belfield Memorial Fund | | 268.82 |
| James H. Cresson Memorial Fund | | 2,267.92 |
| General Endowment Fund | | 19,149.88 |
| John H. Wahl Fund | | 4,583.05 |
| James T. Morris Memorial Fund | | 350.00 |
| Lewis S. Ware Library Fund | | 650.00 |
| Estate of John Turner | | 156.34 |
| Estate of Robert Wright | | 1,935.24 |
| Instruction: Drawing | \$2,680.00 | |
| Mathematics | 2,602.00 | |
| Mechanics | 957.50 | |
| Naval Architecture | 1,090.00 | 7,329.50 |
| Publications: Subscriptions and Sales | \$4,040.96 | |
| Advertising | 4,811.20 | 8,852.16 |
| | | <u>\$111,970.19</u> |
| EXPENSES. | | |
| Building: Wages | \$1,802.07 | |
| Repairs and Maintenance | 709.48 | |
| Taxes, Water Rent and Insurance | 477.67 | |
| Heat, Light and Power | 1,298.42 | |
| Miscellaneous Supplies and Expense | 343.43 | \$4,631.07 |
| Instruction: Drawing | \$1,526.50 | |
| Mathematics | 1,287.50 | |
| Mechanics | 785.00 | |
| Naval Architecture | 1,608.00 | |
| Salaries and Annuities | 1,696.28 | |
| Miscellaneous Expenses | 831.80 | 7,135.08 |
| Library: Salaries | \$7,558.40 | |
| Books and Periodicals | 1,368.69 | |
| Binding | 1,131.06 | |
| Miscellaneous Expense | 229.36 | 10,287.51 |
| Meetings | | 1,301.58 |
| Office and General: Salaries | \$13,143.31 | |
| Office Expense | 1,364.59 | |
| General Expense | 1,298.47 | |
| Auditor and Treasurer | 849.81 | 16,656.18 |

| | | |
|--|-------------|-----------|
| Publications: Printing | \$15,450.95 | |
| Reprints | 1,033.54 | |
| Illustrating | 3,324.22 | |
| Miscellaneous Expense | 582.53 | |
| Year Book | 854.31 | 21,245.55 |
| | | <hr/> |
| Science and Arts | 3,763.95 | |
| Sections | 2,227.42 | |
| Interest and Discount | 1,196.59 | |
| Badges and Certificates | 58.10 | |
| Elections and Resignations | 2.76 | |
| Miscellaneous Income and Expense | 63.19 | |
| | | <hr/> |
| Total | \$68,568.98 | |
| | | <hr/> |
| Surplus | \$43,401.21 | |

The operating surplus as shown was due to the receipt of extraordinary income in the shape of the Harriet Blanchard Legacy of \$55,551.78. The surplus was applied to the reduction of liabilities. There was also an addition of \$21,370.50 during the year in the principal of funds held by the Institute.

Respectfully submitted,

WALTON FORSTALL,
Chairman.

PHILADELPHIA, January 11, 1922.

REPORT OF THE COMMITTEE ON PUBLICATIONS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1921.

To the Board of Managers of The Franklin Institute:

The two principal publications of the Institute, its monthly JOURNAL and the Year Book, have been published as usual. A sufficient number of copies of the JOURNAL were issued to supply a copy to each member of the Institute, to provide copies for sales by home and foreign book dealers, to make exchanges with similar publications of other Institutions and with scientific and technical Journals and to place copies on file in Scientific Libraries.

To meet this demand 2625 copies have been printed each month throughout the year.

The Year Book is also supplied to the membership of the Institute and distributed to the leading Scientific Societies throughout the world, this requiring the publication of 2000 copies.

In addition to the information usually contained, the Year Book for 1921 includes a complete list of all awards granted by the Institute on the recommendation of the Committee on Science and the Arts since the various awards were established.

Many of the lectures delivered in The Franklin Institute course of lectures were printed in the JOURNAL, as well as special articles contributed by leading scientists and technologists with the purpose of making the JOURNAL a record of original research and a report of progress in scientific fields.

An edition of 2000 copies of "Physics of the Air," by Dr. W. J. Humphreys, Professor of Meteorological Physics, U. S. Weather Bureau, was published during the year, and of these, 960 copies were sold. This book contains the most complete treatment of the subject yet published and is recognized as an authority.

The notes from the various Scientific Bureaus and Research Laboratories were continued throughout the year and contained the most recent accounts of the activities of these various Institutions.

The material published under the heading of Current Topics was prepared by several members of the Institute.

While there has been a slight decrease in the price of paper suitable for the printing of the JOURNAL, the cost of publication is still very high. The expenses for the year are as follows:

| | |
|-----------------------------|-------------|
| Printing | \$15,450.95 |
| Reprints | 1,033.54 |
| Illustrations | 3,324.22 |
| Year Book | 854.31 |
| Miscellaneous Expense | 582.53 |
| <hr/> | |
| Total | \$21,245.55 |

Acknowledgement is due to our Associate Editors for valuable coöperation rendered during the year.

Respectfully submitted,

GEORGE D. ROSENGARTEN,

Chairman.

PHILADELPHIA, January 11, 1922.

REPORT OF THE COMMITTEE ON EXHIBITIONS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1921.

To the Board of Managers of The Franklin Institute:

The subject which would properly come within the scope of the activities of the Committee on Exhibitions during the past year, is the Sesqui-Centennial Exhibition. There has been so little progress made with this project that the Chairman of this Committee has not deemed it advisable to call a meeting of the Committee, especially when he found, after a consultation with various members of the Mayor's General Committee and the heads of a number of influential organizations, that a general feeling prevailed that no substantial progress could be made until there was a change in the personnel of the committees having the movement in charge.

Within a very few weeks, the Engineers' Club of Philadelphia, The Philadelphia Chapter of Architects, and The Philadelphia Real Estate Board, have united for the purpose of obtaining some progress; and these three organizations have appointed a representative committee, of which your Chairman is a member, for the purpose of giving the project a thorough study and of making some practical recommendations to the Mayor.

It would seem, however, to the Chairman of your Exhibitions Committee, that until the scope and character of the Exhibition have been determined by the General Committee, and the project given in charge of a very high class executive little substantial progress can be made.

Respectfully submitted,

BENJAMIN FRANKLIN,
Chairman.

PHILADELPHIA, January 11, 1922.

REPORT OF THE COMMITTEE ON SECTIONAL ARRANGEMENTS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1921.

To the Board of Managers of The Franklin Institute:

During the year ending September 30, 1921, nineteen meetings were conducted by the several sections of the Institute.

Section of Physics and Chemistry: Seven meetings.

October 28, 1920.

Dr. Ludwik Silberstein, of the Research Laboratory, Eastman Kodak Company, Rochester, New York, presented the paper of the evening entitled, "Spectrum Analysis and Its Application to the Study of Atomic Structure."

The lecture dealt with the modern theories of line spectra based upon Planck's quantum concept and upon Bohr's assumptions about "stationary" orbits. The subject explained in some detail the example of the Balmer series of hydrogen, and analogous spectra. The properties of the atomic nucleus were touched upon, and the relativistic refinements were taken into account in connection with the fine structure of spectrum lines. Finally some difficulties of these modern theories of spectra were pointed out and critically interpreted. Illustrated by lantern slides.

November 11, 1920.

Dr. Ulric Dahlgren, A.B., M.S., Professor of Biology in Princeton University, presented a communication on "The Production of Motion by Animals." Attention was paid to amoeboid motion, and to motion by means of turgidity, of cilia, and of muscle, and also to the lever systems of motion apparatus. A description was given of the various forms of crawling, swimming, walking and flying. The paper was illustrated by lantern slides.

December 9, 1920.

Dr. John S. Shearer, of the Department of Physics, Cornell University, presented a paper on "Recent Advances in the Production and Application of X-rays." The newer apparatus and the technic for the production of X-rays were described. An account was given of Laue's work on diffraction by crystals, the X-ray Spectrum, and absorption of X-rays for separate wavelengths. The relation of X-rays to the physical theory, to therapy, and to the industries was traced. The subject was illustrated by lantern slides.

January 6, 1921.

The paper of the evening on "Smoke and Incendiary Materiel" was presented by Dr. L. I. Shaw, Assistant Chief Chemist of the Bureau of Mines.

A discussion of the development and uses of portable and non-portable flame projectors, smoke producers, smoke and incendiary bombs, and other smoke and incendiary materiel was given. Consideration was also given to the need and method of employment of such materiel as well as the best type of each class developed or used by the United States, allied or enemy nations. The subject was illustrated by lantern slides and specimens of flame projectors, smoke producers, smoke and incendiary bombs.

January 27, 1921.

The paper of the evening, entitled "America's Petroleum Problem," was presented by Mr. James O. Lewis, Chief Petroleum Technologist, Bureau of Mines, Washington, District of Columbia.

An outline was given of the American petroleum industry. The sources of domestic supply and the total crude oil supply of the world were discussed. The lecture concluded with an account of the various ways in which the domestic supply may be so increased as to meet the growing demand. Lantern slides were used to illustrate the lectures. Published in the *JOURNAL* of the Institute, March, 1921, issue.

March 10, 1921.

The paper of the evening on "Chemical Factors in Nutrition" was presented by Lafayette B. Mendel, Ph.D., Sc.D., Professor of Physiological Chemistry, Yale University, New Haven, Connecticut.

The speaker reviewed the history of the changing conceptions regarding the rôle of digestion in nutrition, and indicated how the newer investigations have contributed to the formulation of present-day views regarding what constitutes a food. Reference was also made to some of the current ideas of metabolism, its relation to the chemical composition of the diet, its variations in health and disease and the limitations of our knowledge thereto. The subject was illustrated by lantern slides. Published in the July, 1921, issue of the *JOURNAL*.

April 28, 1921.

Dr. C. A. Skinner, Chief of the Optical Division, Bureau of Standards, Washington, District of Columbia, presented the paper of the evening on "The Polarimeter and Its Practical Applications." The development of polarimetric apparatus was traced, and the uses of such apparatus were described. The lecture was illustrated with experiments and lantern slides.

Electrical Section: Five meetings.

October 14, 1920.

Major J. O. Mauborgne, of the Signal Corps, U. S. Army, presented a communication on "Resonance Wave Coils for Radio Transmission and Reception."

Consideration was given to the use of the resonance wave coil as a complete antenna system, including the antenna proper, the tuning elements associated with it and the ground or counterpoise. Various forms of resonance wave coils for reception were shown, as well as the action of the electromagnetic waves of the incoming signals on the wave coil. The question of the position of potential loops for various wave-lengths was discussed, the various forms of detector circuits used and method of coupling same to wave coil were described. The directive properties of the resonance wave coil were pointed out. Some consideration was also given to duplex and multiplex reception, as well as the use of the device as a wave-meter. The subject was illustrated by lantern slides and numerous practical demonstrations given with the assistance of Captain Guy Hill, co-inventor of this system, and Major L. M. Evans, of the Signal Corps. Discussing the paper, Dr. Louis Cohen, of Washington, District of Columbia, outlined some further probable early developments in the use of resonance wave coils.

November 4, 1920.

The paper of the evening, entitled "The Application of Radio to Navigation Problems," was presented by Admiral W. H. G. Bullard, Director, Naval Communication Service, Navy Department, Washington, District of Columbia.

Consideration was given to the application of radio telegraphy in the determination of the time and hence the longitude at sea, in furnishing weather reports to vessels at sea and the location and presence of icebergs; in determining the position of ships at sea, and air craft by means of the radio direction finder; in directing ships through narrow channels by the directive pilot cable. The application of the radio compass to determine presence of thunderstorms and forecasting their presence and approximate local direction was also described, as well as the determination of position of ships at sea in thick weather by means of underwater radio signals. Mention was also made of the application of radio to meteorology—for the collection and distribution of synoptic reports throughout the world, of special benefit in forecasting weather for long distance aircraft flights and consequently safety in sea flying. The subject was illustrated by lantern slides. This paper appeared in the June, 1921, issue of the JOURNAL.

February 3, 1921.

Dr. Louis Cohen, Consulting Engineer, Washington, District of Columbia, and Major J. O. Mauborgne, of the Office of the Chief Signal Officer, Washington, District of Columbia, presented a communication entitled "A New Method for the Reception of Radio Signals, Eliminating Static Interference."

The general problem of radio-receiving circuits from the standpoint of selectivity was considered and a resumé was presented of previous efforts in the design of radio-receiving circuits to secure freedom from interference. A description was given of a new type of circuits for receiving radio signals, recently developed by the speakers, making use of resonance wave coils, which effects a great reduction in interferences either that of nearby stations or of static disturbances. The subject was illustrated by lantern slides.

February 24, 1921.

The paper of the evening on "The Economic Aspects of Railway Electrification" was presented by Mr. A. H. Armstrong, M.E., Chairman, Electrification Committee, General Electric Company, Schenectady, New York.

After a review of the present condition of the railway service, due largely to the soaring price of fuel and labor, consideration was given to the economic advantages which will result from the universal replacement of the steam engine. An account was given of the development of the electric locomotive and its use on the several railway lines throughout the United States. Attention was also called to its great reliability and low cost of maintenance. The subject was illustrated by lantern slides. Published in the April, 1921, issue of the JOURNAL.

March 24, 1921.

Mr. W. E. Ruder, B.S., of the Research Laboratory, General Electric Company, Schenectady, New York, read the paper of the evening on "The Science of Electric Welding."

A brief historical review of the subject was given and the methods and apparatus used at present in practice were described. The nature of the metal deposit was also discussed and the recent work done along the line of perfecting it. The commercial aspect of electric welding was considered from the point of view of the manufacturer and the electricity supply company. The subject was illustrated by lantern slides.

Mining and Metallurgical Section: One meeting.

April 7, 1921.

George Otis Smith, Ph.D., Sc.D., LL.D., Director, U. S. Geological Survey, Department of the Interior, Washington, District of Columbia, presented the paper of the evening entitled, "Geology in Partnership with American Industry," in which the growth of the professions of industrial and engineering geologists was described, as well as their part in the development of the coal industries.

Section of Photography and Microscopy: One meeting.

December 2, 1920.

The paper of the evening was presented by C. E. K. Mees, D.Sc., Director, The Research Laboratories of the Eastman Kodak Company, Rochester, New York, entitled "The Structure of Photographic Images."

The relationship between the size, number, and arrangement of the particles of silver halide in the photographic emulsion and the graininess of the image was discussed. Other factors which modify the image were also considered. The subject was illustrated by lantern slides. Published in the JOURNAL, May, 1921, issue.

Mechanical and Engineering Section: Five meetings.

January 13, 1921.

Mr. William Gatewood, of the Newport News Shipbuilding Company, Newport News, Virginia, presented a communication entitled "The Modern Cargo Vessel."

An outline was given of the history and development of cargo vessels and their importance in world economics. The present types were discussed as well as the effect of their material, size, speed, construction, and equipment on their usefulness. Some of the problems involved in their building and operation were discussed and the importance of proper governmental action if the home port of the vessel carrying our cargo is to be in this country instead of abroad, as it was before the war. The subject was illustrated by lantern slides. This paper appeared in the March, 1921, JOURNAL.

February 10, 1921.

Mr. Frank S. Clark, Mechanical Engineer with Stone and Webster, Inc., Boston, Massachusetts, presented the paper of the evening entitled "Modern Steam Power Station Design."

A brief outline was given of the development of the art of power station design corresponding with the progress in the design and construction of station equipment, and the points to be observed in order to secure reliability of service by proper selection, arrangement, and installation of equipment were discussed. Consideration was also given to the various factors affecting the choice of design and sizes of units, such as character of service, peak load, load factor (annual and daily), growth of load, probable ultimate capacity and local topographical and other conditions peculiar to the available sites. The economy of station operation and its attainment by the working out of the proper heat balance, the selection of the operating steam pressure and temperature, the fuel to be used and the simplicity and compactness of the arrangement were discussed in detail. The paper was illustrated by lantern slides.

March 3, 1921.

Mr. C. A. Emerson, Jr., B.S. C.E., Chief, Engineering Division, Department of Health, Commonwealth of Pennsylvania, Harrisburg, Pennsylvania, read a communication entitled, "The Disposal of Industrial Wastes and Stream Pollution."

Consideration was given to the engineering aspect of recent developments in methods of treatment of some of the industrial wastes widely distributed throughout Pennsylvania. The possibilities of the prevention of stream pollution and the recovery of by-products were pointed out. The subject was illustrated by lantern slides. The paper appeared in the June, 1921, JOURNAL.

March 31, 1921.

The paper of the evening entitled "Some Applications of Physics to Ordnance Problems," was presented by Gordon F. Hull, Ph.D., Technical Staff, Office of the Chief of Ordnance, War Department, Washington, District of Columbia.

Experiments to determine the law of air resistance were described as well as the results obtained by holding a projectile in an air stream and measuring the force upon it. Photographs were shown of the disturbed air about a projectile and the underlying physical principles involved. New apparatus and new methods for determining the retardation of a projectile were described and an account was given of experiments to determine the stability of a shell. The subject of pressures in guns was also given consideration. The paper was illustrated by lantern slides. Published in the September, 1921, issue of the JOURNAL.

April 14, 1921.

The following papers were presented:

"The Characteristics of the Electric Locomotive," by Mr. N. W. Storer, General Engineer, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania.

The speed and tractive effort characteristics of the different types of electric locomotives were discussed, and a comparison of the similar characteristics of steam locomotives was presented. Questions relating to speed control, regenerative braking and the advantages and limitations of the electric locomotive with respect to short time, heavy loading, mileage, etc., were also discussed.

Mr. A. W. Gibbs, Chief Mechanical Engineer, Pennsylvania System, Philadelphia, and a member of the Institute's Board of Managers, presented a communication entitled "Some Mechanical Characteristics of High-Speed, High-Power Locomotives."

In this paper were discussed such questions as the mechanical applications of the electric power and the stability of both steam and electric locomotives as vehicles as determined in road tests on recording track.

Both communications were illustrated with lantern slides.

Both papers appeared in the October, 1921, issue of the JOURNAL.

A special lecture was announced for Thursday evening, December 16, 1920, when Mr. W. N. Jennings, of Philadelphia, member of the Institute, read a paper on "The Camera in the Air."

Reference was made to the use of the camera as a part of the equipment of airplanes and dirigibles during the war and its more recent employment for civilian purposes. The speaker has been actively engaged in aerial photography for over thirty years, and has recently made, with a special camera of his own design, a series of remarkable aircapes covering a wide range of subjects. Lantern views from the original negatives were shown.

The total attendance at these meetings was 2392.

Manuscripts for all these papers have not yet been supplied, but it is hoped that the greater number will appear in the JOURNAL during the next several months.

Respectfully submitted,

HARRY F. KELLER,

Chairman.

PHILADELPHIA, January 11, 1922.

REPORT OF THE COMMITTEE ON ENDOWMENT

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1921.

To the Board of Managers of The Franklin Institute:

The funds of the Institute were increased during the year as follows:

| | |
|--|--------------|
| Under the will of Henry W. Bartol, deceased, there was received for the Helene Bonar Bartol Trust Fund | \$300,000.00 |
| Under the will of Harriet Blanchard, deceased: | |
| Cash payment was received from the Executors | 13,773.85 |
| Securities were also received on account of this bequest, a portion of which were sold for..... | 37,542.35 |
| Making total receipts from the Harriet Blanchard Legacy to September 30, 1921..... | 51,316.20 |

Some securities have not yet been disposed of.

Your Committee has been chiefly occupied during the year with the settlement of the H. W. Bartol Estate. Final settlement was made with Mrs. Bartol, the widow, and the securities belonging to her were turned over to her representatives, while the trust funds, in which she has only a life interest, were deposited with the Girard Trust Company as agent for The Franklin Institute.

The French estate of Mr. Bartol has not yet been settled owing in part to an action for divorce started by the Baroness de Monclos, one of Mr. Bartol's daughters. The Franklin Institute's interest in this estate is not large.

As previously reported the administrators overpaid the United States inheritance tax, overlooking the fact that The Franklin Institute as an educational institution not conducted for profit is not subject to the full tax.

Application was made to the Treasury Department for return of the inheritance tax paid in error and the application was refused. Hearing was requested and after long correspondence and repeated visits to Washington, our claim for a refund was allowed to the extent of \$3,358.32 in the H. W. Bartol estate and \$1,538.31 in the B. H. Bartol estate. In addition, a claim for a credit of \$7,838.06 has been allowed.

As the charter of The Franklin Institute as modified by the act of April 25, 1864, limits the real estate held by the Institute to a clear yearly value of not exceeding \$10,000 it became necessary to have this limit increased. Application was, therefore, made to the court to increase the amount of property which may be legally held by The Franklin Institute under the act of June 1, 1915. A decree was signed by the court March 18, 1921, authorizing The Franklin Institute to acquire and hold real and personal estate of the yearly value of \$150,000.

On March 24th, we were informed by the Executor that The Franklin Institute is one of the residuary legatees of the estate of George Theodore Roberts, who died March 11, 1921, and who left his estate for life to an unmarried daughter, on whose death the estate is to be divided among fourteen institutions share and share alike. We have been advised that our interest in this estate would probably be not less than \$40,000.

Respectfully submitted,

COLEMAN SELLERS, JR.,

Chairman.

PHILADELPHIA, January 11, 1922.

REPORT OF THE COMMITTEE ON SCIENCE AND THE ARTS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1921.

To the President and Members of The Franklin Institute:

The year just closed was the eighty-seventh in which the Committee on Science and the Arts has rendered service to the Institute. During this year the Committee has investigated and made final disposition of twenty cases and sixteen are now pending.

A reading of the appendix to this report will show the scope of the activities of the Committee in its investigations, the subjects including many fields of scientific investigation and industrial application.

The minutes of the Committee have furnished data from which there has been published in the Year Book for 1921, a list of all awards made on its recommendation since the establishment of the several awards. These lists total 892 awards, divided as follows:

| | |
|-----------------------------|-----|
| Franklin Medals | 14 |
| Cresson Medals | 141 |
| Potts Medals | 18 |
| Longstreth Medals | 190 |
| Certificates of Merit | 74 |
| Scott Medals | 455 |

The average number of awards made per year is 19.17 and the awards made during the past year were 19.

The Standing Sub-Committee on The Franklin Medal and the Standing Sub-Committee on Literature met as required during the year, and upon their recommendation the awards shown in the appended statement were made.

The Sub-Committee on New Subjects and Preliminary Examination met each month and considered forty new cases. Applications were received covering eleven of these cases and Sub-Committees of Investigation were appointed. The work of this sub-committee is of great value since by its examinations it invites the attention of the Committee to suitable subjects for investigation and prevents unsuitable ones from coming to its attention.

Recipients of awards were invited to attend the Stated Meetings of the Institute to receive them from the hands of the President, and in many cases these invitations were accepted.

Two Franklin Medals were presented at the May Meeting, one to Professor Charles Fabry and one to Dr. Frank J. Sprague. After a statement by Dr. Joseph S. Ames, of the Johns Hopkins University, concerning the scientific work of Dr. Charles Fabry, Professor of Physics in the University of Paris, Sorbonne, the medal awarded to Professor Fabry was received by His Excellency M. Jusserand, the Ambassador of the French Republic. M. Jusserand in accepting the medal and diploma for transmission to Professor Fabry, said in part: "It is with heartfelt appreciation that I accept on behalf of the French Government, for Professor Charles Fabry, this Medal and the Diplomas which accompany it. They will be duly forwarded and my Government will be informed of what has just taken place, and I hope that there shall be another to add to these honors, one which will not be less appreciated, that is the text of the tribute we have just heard paid Professor Fabry by Doctor Ames."

The work of Dr. Frank J. Sprague in the development of electric traction and the application of electricity to power purposes was described by Mr. W. C. L'Eglin, who presented Dr. Sprague to Mr. Coleman Sellers, Jr., the Chairman of the meeting. Dr. Sprague said in part: "I would not be quite human if, on an occasion of this kind, when receiving from the oldest and most dignified scientific institution of this country so notable a mark of its consideration, in the award of the medal bearing the name of the great Franklin and the adding of my name to the illustrious list carried on your Honorary roll, I did not feel both a sense of pride and humility—especially as my work has been less that of the physicist than of one who has endeavored to make use of the fundamental facts discovered by patient delvers into the mysteries of the physical world."

Dr. Ames then read the paper on "Studies in the Field of Light Radiations,"

prepared by Professor Fabry for the occasion, and Dr. Sprague presented a paper on "Electric Traction—A Review."

The attendance at the Stated Meetings of the Committee on Science and the Arts has been most satisfactory. The dinners preceding the meetings have been well attended and serve to make those who attend better acquainted as well as to give an opportunity for the discussion of questions pertaining to the work of the Committee.

A detailed statement of the work of the Committee during the past year is appended.

Respectfully submitted,

C. W. MASLAND,
Chairman.

APPENDIX.

STATEMENT OF THE COMMITTEE'S OPERATION FOR THE YEAR ENDING SEPTEMBER 30, 1921.

| | |
|-------------------------------------|-------|
| Cases pending October 1, 1920 | 17 |
| Applications during the year | 11 |
| Special reports | 2 |
| | <hr/> |
| | 30 |
| Disposed of during the year | 20 |
| Leaving pending | 10 |

AWARDS MADE.

| | |
|------------------------------------|-------|
| Franklin Medal Awards | 2 |
| Elliott Cresson Awards. | 2 |
| Howard N. Potts Awards. | 3 |
| Edward Longstreth Awards. | 8 |
| Certificates of Merit Awards. | 4 |
| | <hr/> |
| | 19 |

AWARDS MADE DURING THE YEAR.

THE FRANKLIN MEDAL.

Professor Charles Fabry, of Paris, France, "in recognition of his numerous and highly important contributions in the field of physical science, particularly the solution of optical and spectroscopical problems of fundamental importance."

Mr. Frank Julian Sprague, of New York, N. Y., in recognition of his many and fundamentally important inventions and achievements in the field of electrical engineering, notably his contributions to the development of the electric motor and its application to industrial purposes, and in the art of electric traction, signally important in forming the basis of world-wide industries and promoting human welfare."

THE ELLIOTT CRESSON MEDAL.

Byron E. Eldred, of New York, N. Y., for the Low Expansion Leading-in Wire for Incandescent Electric Lamps.

W. L. R. Emmet, of Schenectady, New York, for his work on the Electric Propulsion of Ships and Prime Movers.

THE HOWARD N. POTTS MEDAL.

Edward Payson Bullard, Jr., of Bridgeport, Connecticut, for the "Automatic Machine Tool."

Elmer V. McCollum, of Baltimore, Maryland, for his paper entitled "Nutrition and Physical Efficiency," in the JOURNAL.

Alfred O. Tate, of Cranston, Rhode Island, for his Electrolytic Process of Waterproofing Textile Fabrics.

THE EDWARD LONGSTRETH MEDAL.

Leason H. Adams, of Washington, D. C., for the paper prepared in conjunction with Erskine D. Williamson, entitled "The Annealing of Glass," in the JOURNAL.

Professor J. Bergonie, of Bordeaux, France, for his Application of Electro-Magnetic Means and Apparatus to the Location of Metallic Fragments Imbedded in Muscular Tissues.

W. Barton Eddison, of Ardsley-on-Hudson, New York, for his inventions and improvements embodied in the Surface Combustion Burner.

B. H. Hite, of Morgantown, West Virginia, for his Method of Sterilization by High Pressure.

Goddank L. Kothny, of Philadelphia, Pennsylvania, jointly with Robert Suczek, for his inventions embodied in the Radojet Air Pump.

Jacob M. Spitzglass, of Chicago, Illinois, for his inventions embodied in the Republic Flow Meter.

Robert Suczek, of Philadelphia, Pennsylvania, jointly with Goddank L. Kothny for his inventions embodied in the Radojet Air Pump.

Erskine D. Williamson, of Washington, D. C., for the paper prepared in conjunction with Leason H. Adams, entitled "The Annealing of Glass," in the JOURNAL.

THE CERTIFICATE OF MERIT.

Eugene C. Bingham, of Easton, Pa. for the inventions and improvements embodied in the Variable Pressure Viscometer.

Joseph S. Hepburn, of Philadelphia, Pennsylvania, for the paper prepared in conjunction with E. Quintard St. John and Frank Morton Jones, entitled "The Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ," in the JOURNAL.

Frank Morton Jones, of Wilmington, Delaware, for the paper prepared in conjunction with Joseph S. Hepburn and E. Quintard St. John, entitled "The Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ," in the JOURNAL.

E. Quintard St. John, of Philadelphia, Pa., for the paper prepared in conjunction with Joseph S. Hepburn and Frank M. Jones, entitled "The Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ," in the JOURNAL.

THE FRANKLIN INSTITUTE AWARDS

OCTOBER, 1921, TO JUNE, 1922.

THE FRANKLIN MEDAL.

TO

Dr. Ralph Modjeski, of New York "in recognition of his signal achievements as a designer and builder of structures, mainly bridges, many of them epoch-marking in the history of the engineering profession, beautiful as well as useful, involving on the part of the designer vision, courage and technique of the highest order."

Sir Joseph John Thomson, of Cambridge, England, "in recognition of the immeasurable service he has rendered to the world as teacher and leader of thought in that domain of science especially related to a fundamental knowledge of electricity and the constitution of matter."

THE HOWARD N. POTTS MEDAL.

TO

E. G. Coker, of London England, for his Method of Determining Stress by Photo-Elastic Means.

Richard B. Moore, of Washington, D. C., for his paper entitled "Helium, Its History, Properties and Commercial Development."

Messrs. John Morris Weiss and Charles Raymond Downs, of New York, for their joint invention of the Vapor Phase Oxidation of Benzene to Maleic Acid.

THE EDWARD LONGSTRETH MEDAL.

TO

Samuel T. Freas, of Trenton, New Jersey, for his inventions and improvements embodied in the "Interlocking" Tooth Saw.

James Hartness, of Springfield, Vermont, for his Screw Thread Comparator.

Thomas Willing Hicks, of Minneapolis, Minnesota, for his "Once-Over" Tiller.

Joseph F. Keller, of Brooklyn, New York, for his inventions and improvements embodied in the Automatic Die Cutting Machine.

Martin F. Tiernan, of Newark, New Jersey, jointly with Charles F. Wallace, for his inventions embodied in the Chlorinator.

Charles F. Wallace, of Newark, New Jersey, jointly with Martin F. Tiernan, for his inventions embodied in the Chlorinator.

THE CERTIFICATE OF MERIT.

TO

Rear Admiral W. H. G. Bullard, of Washington D. C., for his paper entitled
"The Application of Radio to Navigation Problems."

Harry Etchells, of Sheffield, England, jointly with H. A. Greaves for his
inventions and improvements embodied in the Electric Arc Furnace.

H. A. Greaves, of Sheffield, England, jointly with Harry Etchells, for his
inventions and improvements embodied in the Electric Arc Furnace.

Charles E. Mendenhall, of Madison, Wisconsin, for his paper entitled
"Aeronautic Instruments."

Arthur H. Pitney, of Stamford, Connecticut, for his Postage Meter.

Walter Kidde and Company, of New York, for their improvements made
on the Rich System of Detecting and Extinguishing Marine Fires.

AWARDS

1835-1922.

FRANKLIN MEDAL AWARDS.

1915-1921.

ARRHENIUS, SVANTE AUGUST.

"In recognition of his notable contributions to the theory of physical science which have found unprecedentedly extended and fruitful application in the experimental study of chemical, physical, biological and cosmic phenomena, as well as in industrial chemistry."

1920.

CARTY, JOHN J.

"In recognition of his long-continued activities in the telephone service, his important and varied contributions to the telephone art, his work in the establishment of the principles of telephone engineering, and his signal success in directing the efforts of a large staff of engineers and scientists to the accomplishment of the telephonic transmission of speech over vast distances."

1916.

DEWAR, SIR JAMES.

"In recognition of his numerous and most important contributions to our knowledge of physical and chemical phenomena, and his great skill and inventive genius in attacking and solving chemical and physical problems of the first magnitude."

1919.

EDISON, THOMAS ALVA.

"In recognition of the value of numerous basic inventions and discoveries forming the foundation of world-wide industries, signally contributing to the well-being, comfort and pleasure of the human race."

1915.

FABRY, CHARLES.

"In recognition of his numerous and highly important contributions in the field of physical science, particularly the solution of optical and spectroscopical problems of fundamental importance."

1921.

LORENTZ, HENDRIK ANTOON.

"In recognition of his researches which have so largely contributed to laying on a new foundation our knowledge of the nature of light and in developing our ideas concerning the ultimate construction of matter."

1917.

MARCONI, GUGLIELMO.

"In recognition of his brilliant inception and successful development of the application of magneto-electric waves to the transmission of signals and telegrams without the use of metallic conductors."

1918.

MENDENHALL, THOMAS CORWIN.

"In recognition of his fruitful and indefatigable labors in physical research, particularly his contributions to our knowledge of physical constants and electrical standards."

1918.

MODJESKI, RALPH.

"In recognition of his signal achievements as a designer and a builder of structures, mainly bridges, many of them epoch-marking in the history of the engineering profession, beautiful as well as useful, involving on the part of the designer, vision, courage and technique of the highest order."

1922.

ONNES, HEIKE KAMERLINGH.

"In recognition of his long-continued and indefatigable labors in low-temperature research, which have enriched physical science, not only with a great number of new methods and ingenious devices, but also with achievements and discoveries of the first magnitude."

1915.

PARSONS, SIR CHARLES ALGERNON.

"In recognition of his epoch-making success in the development of the steam turbine, which has revolutionized the art of steam engineering, particularly in regard to the propulsion of mercantile and naval vessels and the driving of electrical generators."

1920.

RICHARDS, THEODORE WILLIAM.

"In recognition of his numerous and important contributions to inorganic, physical and theoretical chemistry, and particularly his classical series of redeterminations of the atomic weights of the more important chemical elements."

1916.

SPRAGUE, FRANK J.

"In recognition of his many and fundamentally important inventions and achievements in the field of electrical engineering, notably his contributions to the development of the electric motor and its application to industrial purposes, and in the art of electric traction, signally important in forming the basis of world-wide industries and promoting human welfare."

1921.

SQUIER, GEORGE OWEN.

"In recognition of his valuable contributions to physical science, his important and varied inventions in multiplex telephony and telegraphy and in ocean cabling and his eminent success in organizing and directing the air and signal services of the U. S. Army in the World War."
1919.

TAYLOR, DAVID WATSON.

"In recognition of his fundamental contributions to the theory of ship resistance and screw propulsion and of his signal success in the application of correct theory to the practical design of varied type of war vessels in the United States Navy."
1917.

THOMSON, SIR JOSEPH JOHN.

"In recognition of the immeasurable service he has rendered to the world as teacher and leader of thought in that domain of science especially related to a fundamental knowledge of electricity and the constitution of matter."
1922.

CRESSON MEDAL AWARDS

1856-1921.

ACKER, C. E.

Process of Manufacturing Caustic, etc.—1902.

ALBERT, CHARLES F.

Violins and Bows.—1887.

AMERICAN COTTON COMPANY.

Round Lap Bale System.—1901.

AMERICAN PAPER BOTTLE COMPANY.

Paper Bottles for Various Purposes.—1906.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY.

Contributions to the Modern Telephone Art.—1916.

ATWATER, W. O., and ROSA, E. B.

Respiration Calorimeter.—1900.

AUTOMATIC ELECTRIC COMPANY.

Automatic Telephony.—1910.

BAEYER, J. F. A. VON.

Research Work in Organic Chemistry.—1912.

BALDWIN LOCOMOTIVE WORKS.

Contributions to the Evolution of the American Locomotive.—1907.

BATCHELLER, C. H.

Compound Locomotive.—1893.

BATES, STOCKTON; SHAW, EDWIN, and VON CULIN, G. M.

Spindle Support.—1891.

BELL, ALEXANDER GRAHAM.

Electrical Transmission of Speech.—1912.

BERLINER, EMILE.

Telephony and Sound Reproduction.—1913.

- BEVINGTON, J. H.
Welding Metal and Spinning and Shaping Tools.—1891.
- BILGRAM, HUGO.
Bevel Gear Cutter.—1887.
- BONWILL, W. G. A.
Electro-Magnetic Dental Mallet.—1876.
- BORSCH, DR. LOUIS.
Solid Invisible Bifocal Lens.—1907.
- BOWER, HENRY.
Inodorous Glycerine.—1878.
- BRASHEAR, JOHN A.
Leading Work in Astronomic Science.—1910.
- CASTNER, H. Y.
Electrolytic Process of Decomposing Alkaline Chlorides for the Production of Caustic and Chlorine.—1897.
- CHABOT, CYPRIEN.
Shoe Sewing Machine.—1885.
- CHAMBERS BROTHERS.
Bolt and Rivet Clipper.—1878.
- CHARLTON, J.
Shaft Coupling.—1876.
- CLAMER, G. H.
Methods of Eliminating Metals from Mixtures of Metals.—1904
- COOPER-HEWITT, P.
Mercury Rectifier.—1910.
- CORSCADEN, T.
All-Wrought Steel Belt Pulley.—1898.
- COWLES, EUGENE H., AND ALFRED, H.
Electric Smelting Furnace.—1887.
- COWPER, EDWARD A., AND ROBERTSON, T. HART.
Writing Telegraph.—1889.
- CROOKES, SIR WILLIAM.
Discoveries in Chemistry.—1912.
- CURIE, PROF. AND MADAME.
Researches Resulting in the Discovery of Radium.—1909
- DELANDTSHEER, NORBERT.
Machine for Treating Flax.—1879.
- DELANY, P. B.
Synchronous Multiplex Telegraphy.—1886.
- DELANY, P. B.
System of Machine Telegraphy.—1896.
- DELANY, P. B.
Telepost.—1908.
- DIESEL, R.
Diesel Motor.—1901.
- DODGE, J. M.
System of Storing Coal.—1904.

DUDLEY, P. H.

Dynamograph.—1877.

EDER, J. MARIA.

Researches in Photochemistry.—1914.

ELDRED, BYRON E.

Low-Expansion Leading-in Wire for Incandescent Electric Lamps.—1921.

EMMET, WILLIAM LE ROY.

Work on Electrical Propulsion of Ships and Prime Movers.—1920.

FERRILL, J. L.

Process of Fireproofing Wood.—1903.

FISCHER, EMIL.

Contributions to Organic Chemistry.—1913.

FISKE, B. A.

Range Finder.—1892.

FISS, BARNES, ERBEN & Co.

Worsted Yarns.—1875.

FORBES, JOHN S., AND WATERHOUSE, A. G.

Art of Automatically Heating and Sterilizing Fluids.—1901.

FRITZ, JOHN.

Advancement of Steel Industries.—1910.

GAEDE, W.

Molecular Air Pump.—1909.

GANS, ROBERT.

Permutit.—1916.

GAYLEY, J.

Dry Air Blast in Blast Furnace Operation.—1909.

GILL, W. L.

School City.—1903.

GOLDSCHMIDT, HANS.

Alumino-thermics.—1904.

GOLDSCHMIDT, V.

New Theory of Musical Harmony.—1903.

GRAY, E.

Telautograph.—1897.

GRAY NATIONAL TELAUTOGRAPH COMPANY.

Telautograph.—1912.

GRISCOM, W. WOODNUTT.

Electric Motor and Battery.—1881.

HADFIELD, ROBERT A.

Advancement of Metallurgical Science.—1910.

HAMMER, W. J.

Historic Collection of Incandescent Electric Lamps.—1906.

HAMMOND, J.

Typewriter.—1890.

HAUPT, L. M.

Reaction Breakwater.—1901.

- HAYES, MAYER AND COMPANY.
Manufacture of Files.—1890.
- HEANY, J. ALLEN.
Fireproof Insulated Wire.—1907.
- HERSCHEL, CLEMENS.
Venturi Meter.—1898.
- HOLLERITH, H.
Electric Tabulating Device.—1890.
- HOLMES, P. H.
Lubricant Bearing.—1892.
- HOUGH, R. B.
Contributions to the Characteristics and Uses of the American Woods.—
1908.
- HOWE, H. M.
Experimental Research on Steel.—1895.
- HOWE, H. M.
Metallurgy of Steel.—1892.
- IVES, FREDERICK E.
Color Photography.—1893.
- JENKINS, C. FRANCIS.
"Phantoscope."—1898.
- LANSTON, T.
Monotype Machine.—1896.
- LEVY, L. E.
Acid Blast Method and Apparatus for Etching Metal Plates.—1900.
- LEVY, L. E.
Machine for Powdering Plates for Etching.—1904.
- LEWIS, COL. ISAAC NEWTON.
Machine Gun.—1918.
- LINDE, KARL P. G.
Refrigeration Processes.—1914.
- LOWE, THADDEUS S. C.
Water Gas Process and Apparatus.—1886.
- LOVEKIN, L. D.
Expanding and Flanging Machinery and Tools for all Classes of Tubes.—
1904.
- LUMIÈRE, AUGUSTE AND LOUIS.
Color Photography.—1909.
- MALLET, A.
Articulated Compound Locomotive.—1908.
- MARKS, G. E.
Improvements in Artificial Limbs.—1893.
- MASON AND HAMLIN COMPANY.
Liszt Organ.—1901.
- MERGENTHALER, O.
Linotype.—1889.

WHEELER, A. A.

Work in Physical Optics.—1912.

WILSON, HENRI.

Investigations with the Electric Furnace.—1898.

WILLIAMS, E. W.

Determination of Fundamental Magnitudes in Chemistry.—1912.

WORME, ALFRED.

Achievements in Civil Engineering.—1912.

NORTHROP, EDWIN F.

Electric Furnace and High Temperature Investigations.—1917.

OLSEN, TINIUS.

Testing Machine.—1891.

QIT AND BREWER.

China and Porcelain Wares.—1886.

OUTERBRIDGE, A. E. JR.

Molecular Structure of Cast Iron.—1904.

OWENS, MICHAEL J.

Bottle Blowing Machine—1915.

PARKER, J. C.

Steam Generator.—1902.

PECKOVER, J.

Stone Sawing Machine.—1895.

PELTON, LESTER A.

Water Wheel.—1894.

PENCOYD IRON WORKS.

Bridge Construction.—1900.

PHILLIPS, F.

Pressed Steel Pulley for Power Transmission.—1907.

POWERS AND WEIGHTMAN.

Exhibit at The Franklin Institute Exhibition of 1874.—1875.

PRATT AND WHITNEY COMPANY.

System of Interchangeable Cut Gears.—1886.

PUPIN, M. I.

Art of Reducing Attenuation of Electrical Waves and Apparatus.—1905.

RAMSAY, R. H.

Railway Car Transfer Apparatus.—1886.

RAMSAY, SIR WILLIAM.

Discoveries in Chemistry.—1913.

RANDOLPH, ISHAM.

Achievements in Civil Engineering.—1913.

RAYLEIGH, LORD.

Researches in Physical Science.—1913.

ROBERTSON, T. HART AND COWPER, ED. A.

Writing Telegraph.—1889.

- ROENTGEN, W. C.
Investigations of a New Kind of Ray.—1897.
- ROSCOE, SIR H. E.
Researches in Chemistry.—1912.
- RUTHERFORD, ERNEST.
Advancement of Knowledge of Electrical Theory.—1910.
- SAUVEUR, A.
Metallography of Iron and Steel.—1910.
- SHAW, EDWIN; BATES, STOCKTON; VON CULIN, G. M.
Spindle Support.—1891.
- SHAW, THOMAS.
Automatic Device for Testing Mine Gases and System of Mine Signalling.—1887.
- SIMONDS, G. F.
Universal Rolling Machine.—1889.
- SMITH, EDGAR F.
Work in Electrochemistry.—1914.
- SPELLIER, LOUIS H.
Time Telegraph.—1881.
- SPRAGUE, F. J.
Multiple Unit System of Electric Traction.—1903.
- SQUIER, MAJOR GEO. OWEN.
Multiplex Telephony.—1912.
- STEINMETZ, C. P.
Application of Analytics to Electrical Engineering.—1913.
- STRATTON, S. W.
Leading Work in Metrology.—1912.
- TALBOT, B.
Open Hearth Steel Process.—1909.
- TATHAM, W. P.
Printing Press.—1875.
- TAYLOR, E. R.
Electric Furnace and Process of Manufacturing Bisulphide of Carbon.—1907.
- TAYLOR, FREDERICK W., AND WHITE, MAUNSEL.
Process of Treating Tool Steel.—1902.
- TESLA, NIKOLA.
Alternating Electric Currents of High Frequency.—1894.
- THOMSON, ELIHU.
Industrial Applications of Electricity.—1912.
- THOMSON, JOSEPH J.
Leading Work in Physical Science.—1910.
- TILGHMAN, B. C.
Sand Blast.—1875.
- TURNER, W. V.
Air Brake Design and Application.—1909.

COBLENTZ, W. W.

"Reflecting Power of Metals" (Paper).—1911.

COKER, E. G.

Method of Determining Stress by Photo-Elastic Means.—1922.

DAHLGREN, ULRIC.

"The Production of Light by Animals" (Paper).—1917.

DOWNES, CHARLES RAYMOND, AND WEISS, JOHN MORRIS.

Vapor Phase Oxidation of Benzene to Maleic Acid.—1922.

GRAY, ALEXANDER.

"Modern Dynamo Electric Machinery" (Paper).—1918.

HUMPHREYS, WILLIAM J.

"The Thunderstorm and Its Phenomena" (Paper).—1915.

JANNEY, REYNOLD, AND WILLIAMS, HARVEY D.

Hydraulic Speed Gear.—1919.

KENNELLY, A. E.

Linear Hot-Wire Anemometer.—1918.

KING, LOUIS V.

Improvements in Linear Hot-Wire Anemometers.—1918.

LANDRETH, CLARENCE P.

Direct Oxidation Process.—1919.

LYON, T. L., and BIZZELL, JAMES A.

"Plants and Relation to Nitrate in Soils" (Paper).—1912.

MCCOLLUM, E. V.

"Nutrition and Physical Efficiency" (Paper).—1921.

MODJESKI, RALPH.

"Design of Large Bridges with Special Reference to Quebec Bridge" (Paper).—1914.

MOORE, RICHARD B.

"Helium, its History, Properties and Commercial Development" (Paper).—1922.

MURRAY, W. S.

"Conditions Affecting the Success of Main Line Electrification" (Paper).—1916.

TATE, ALFRED O.

Electrolytic Waterproofing of Textile Fabrics.—1921.

WEISS, JOHN MORRIS, AND DOWNES, CHARLES RAYMOND.

Vapor Phase Oxidation of Benzene to Maleic Acid.—1922.

WILLIAMS, HARVEY D., AND JANNEY, REYNOLD.

Hydraulic Speed Gear.—1919.

LONGSTRETH MEDAL AWARDS

1890-1921.

ABBE, C.

"Meteorology" (Paper).—1913.

ABBOTT, ROBERT R.

"Modern Steels and Their Heat Treatment" (Paper).—1916.

ACHARD, F. H., KENNELLY, A. E., DANA, A. S.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—1917.

ADAMS, L. H., AND WILLIAMSON, E. D.

"The Annealing of Glass" (Paper).—1921

ADAMS, W. G., AND FORBES, J. S.

Stop Valve for Radiators.—1893.

ALEXANDER, JOHN E.

"Phonosphere."—1905.

ALTENEDEK, THEODORE AND SONS.

Drawing Pen.—1905.

ARMSTRONG, WM. T., AND COX, JACOB D.

Grip Socket.—1896.

ARNOLD, B. J.

Magnetic Clutches and System of Electric Power Station Construction.—1903.

AUSTIN, JOHN T.

Austin Organ.—1917.

BALL, JOHN D.

"Investigations of Magnetic Laws for Steel and Other Materials" (Paper).—1917.

BASKERVILLE, C.

"Chemistry of Anæsthetics" (Paper).—1912.

BATES, E. G.

Typographic Numbering Machine.—1895.

BAUSH, CHRISTIAN H.

Radial Drilling Machine.—1894.

BECKER, CHRISTOPHER A.

Chainomatic Balance.—1917.

BENNETT, CHARLES A.

Typewriter.—1909.

BERGONIE, J.

Use of A. C. Electro-Magnet in Surgery.—1921.

BLOEDE, V. G.

Process of Tinting Fabrics.—1894.

BONNELL, RUSSELL, AND SCHMITT, HENRY J.

Gate Valves.—1901.

BRADBURN AND PENNOCK.

Process of Obtaining Alumina from Bauxite.—1893.

BREED, G.

Apparatus for Producing Musical Sounds by Electricity.—1908.

- BRISTOL, W. H.
Recording Pressure Gauge.—1894.
- BROWN, HAROLD P., AND EDISON, THOMAS A.
Rail Bonds and Electrical Contacts.—1899.
- CAFFREY, C. S., AND COMPANY.
Improvement in Carriages and Wagons.—1900.
- CARTY, J. J.
Bridging Bell System.—1905.
- CHAFFEE, E. L.
"Continuous Electric Oscillations" (Paper).—1913.
- CHANCE, E. M.
"Pathogenic Mine Atmospheres" (Paper).—1912.
- CHENEY, W. L.
Lathe Tool and Support.—1895.
- CHENOWETH, A. C.
Method of Constructing Sewers.—1892.
- CLARK, WM. H., AND COLLINS, FRANK W.
Cortlandt, Howe Ventilating Stove.—1894.
- COLLINS, FRANK W., AND CLARK, WM. H.
Ventilating Stove.—1894.
- COLT'S PATENT FIRE ARMS MANUFACTURING COMPANY.
Automatic Pistols.—1906.
- COOPER, W. S.
Specimens of Aluminum Castings.—1895.
- COX, JACOB D., AND ARMSTRONG, WM. T.
Grip Socket.—1896.
- CREIGHTON, H. JERMAIN.
"The Deteriorating Action of Salt and Brine on Reinforced Concrete"
(Paper).—1918.
- CRISFIELD, J. A. P.
Moisture Determinator for Coke and the Like.—1909.
- CUMMINGS, H. H.
Speed Controllers.—1903.
- CUSHMAN, ALLERTON S.
"Researches on the Corrosion of Iron and Steel" (Paper).—1908.
- DANA, A. S., KENNELLY, A. E., ACHARD, F. H.
"Experimental Researches on the Skin Effect in Steel Rails" (Paper).
—1917.
- DESHLER, CHARLES, and McALLISTER, EDWARD J.
Portable Photometer.—1900.
- DEVoe, W. R.
Conduit Electric Railway.—1894.
- DODGE, WALLACE H.
Wooden Split Pulley.—1891.

- HERR, H. T.
"Development of Steam Turbines" (Paper).—1914.
- HICKS, THOMAS WILLING.
"Once-Over" Tiller.—1922.
- HILL, F. B.
Improvement in the Treatment of Sewage.—1893.
- HIRSCH, H. H.
Electric Safety Lamp.—1914.
- HITE, B. H.
Sterilization by High Pressure.—1920.
- HOADLEY, H. G.; WILLIAMS, H. D.; LEWIS, E. C.
Lever and Ratch Attachment.—1900.
- HOCHKLASSEN, H.; FAY, C. N., AND SHOLES, Z. G.
Typewriting Machine.—1901.
- HOLLINGSHEAD, W. B.
Automatic Disinfectant Ejector.—1898.
- HOLMAN, A. J., AND COMPANY.
Self-Pronouncing Bibles.—1900.
- HOOVEN, OWENS, RENTSCHLER CO.
Hooven Automatic Typewriter.—1917.
- HUMPHREYS, W. J.
"Volcanic Dust, Climatic Changes and Ice Ages" (Paper).—1914.
- HYDE, E. P.
"Physical Production of Light" (Paper).—1911.
- INTERNATIONAL LIGHT, HEAT AND POWER COMPANY.
Incandescent Lamp.—1901.
- INTERNATIONAL MONEY MACHINE COMPANY.
Money Machine.—1917.
- IVES, H. E., KINGSBURY, E. F., KARRER, E.
"The Physics of the Welsbach Mantle" (Paper).—1919.
- IVES, H. E.
"Artificial Daylight" (Paper).—1915.
- IVES, H. E.
Improvements in Diffraction Color Photographs and Mode of Making Same.—1907.
- IVES, F. E.
Photo-Micrographic Process.—1903.
- IVINS, E.
Product of Tube Making.—1894.
- JOHNSTON, A. L.
Automatic Safe Electric Disconnecter.—1894.
- JONES, H. C.
"Nature of Solution" (Paper).—1913.
- JONES, J. R.
Machine for Rolling Car Wheels.—1892.

KARNS, J. P., COMPANY.

Tunneling Machine.—1909.

KARRER, E.; KINGSBURY, E. F.; IVES, H. E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

KELLER, JOSEPH F.

Automatic Die Cutting Machine.—1922.

KEMP, W. W., AND VAN HORN, W. H.

Gas System.—1919.

KENNELLY, A. E.; ACHARD, F. H.; DANA, A. S.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—1917.

KINGSBURY, E. F.; KARRER, E.; IVES, H. E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

KINKEAD MANUFACTURING COMPANY.

Apparatus for Aligning and Levelling Shafting.—1914.

KITSON, A.

System of Oil Heating and Incandescent Lighting.—1901.

KNAPP, I. N.

"Natural Gas" (Paper).—1913.

KOTHNY, G. L., AND SUCZEK, ROBERT.

Radojet Air Pump.—1920.

KROLL, G.

Convertible Carriage.—1896.

LAIRD, SCHOBBER AND COMPANY.

General Excellence in Manufacturing Shoes.—1900

LATHROP, E., AND SCHREINER, O.

"Organic Constituents in Soil" (Paper). 1912.

LEDOUX, J. W.

Fluid Meter.—1919.

LEEDS, MORRIS E.

Recording Devices.—1920.

LENKER, WILL G.

L-E-Vation Rod.—1915.

LEVY, MAX

Counting Chamber for Haemocytometer.—1917.

LEWIS, E. C.; WILLIAMS, H. D.; HOADLEY, H. G.

Lever and Ratch Attachment.—1900.

LEWIS, JOHN F., AND MATTES, WM. F.

Locomotive Cylinder Lubricator.—1894.

LEWIS, W.

Inertia Indicator.—1899.

LLOYD, M. G.

"Magnetic Hysteresis" (Paper).—1911.

LODGE, GEORGE.

Electro-Magnetic Street Railway System.—1896.

LUCKIESH, M.

"The Visibility of Airplanes" (Paper). 1920.

- LUPTON, D., SON AND COMPANY.
Automatic Closing Fireproof Metal Window.—1904.
- MACKAY, WILLIAM M.
Operating Valve.—1893.
- MCALLISTER, E. J., AND DESCHLER, CHARLES.
Portable Photometer.—1900.
- MARSH, E. B.
Metallic Corner Bead.—1897.
- MATTES, WILLIAM F., AND LEWIS, J. F.
Locomotive Cylinder Lubricator.—1894.
- MEEKER, G. H.
New Apparatus and Method in Clinical Chemistry.—1906.
- MENLO PARK CERAMIC WORKS.
Decorative Tile and Faience Work.—1890.
- MILEY, HENRY M., AND MICHAEL.
Color Photography.—1905.
- MILLER, DAYTON C.
"A 32-Element Harmonic Synthesizer" (Paper).—1917.
- MOORE, RICHARD B.
"Biography of Sir William Ramsay" (Paper).—1919.
- MORSELL, W. F. C.
Sectional Models for Stereometric Representation.—1903.
- NORTHROP, E. F.
"Vortex Motion in Liquids" (Paper).—1912.
- PANTASOTE LEATHER COMPANY.
"Pantasote."—1896.
- PHILADELPHIA CREMATION SOCIETY.
System of Cremation.—1892.
- PITKIN, A. J.
Compound Locomotive.—1891.
- PITTLER, J. W., VON
Turret Lathe.—1903.
- PRESTWICH, JOHN ALFRED.
Fluid Gauge.—1918.
- RANKIN, GEORGE A.
"Portland Cement" (Paper).—1917.
- RECKLINGHAUSEN, M. VON.
"Ultra-Violet Rays" (Paper).—1915.
- REESE, B. D.
Dirigible Balloon.—1910.
- REEVES, MILTON O.
Variable Speed Countershaft.—1900.
- REGAN, H. C., JR.
Closed Conduit Electric Railway.—1897.

YEAR BOOK OF

- Pressure Friction Clutch.—1897.
- SCHWENK, F. H.
Patented Metal. 1917.
- Steel.
- Windows. 1892.
- 1000
COMPANY.
Holding. 1893.
- System 1892.
- "Combustible Cases" (Paper).—1914.
- In Trailing Trucks for Locomotives.—1910
- Automatic Water Heater.—1904.
- W. B. BAKER
1891
- Platform Weighing Scale.—1919.
- ALAN AND SONS, JOSEPH.
1894.
- HENRY J. AND WINNELL, RUSSELL.
1891
- FRED W. AND KINGLAND, ALBERT.
BRIAN MARY. 1917.
- L. C. LATHROP, P.
Concrements in Soils" (Paper).—1912.
- P. H.
PARKS. 1903.
- Screening Machines.—1904.
- COMPANY.
1916.
- 1914.
- 1914.
- 1903.
- Hochklausen, H.
Machine. 1901.

- SIEBER, JOSEPH, AND SCHMIDT, MAX E.
Movable Side-Walk.—1894.
- SKINNER, JOSHUA J.
"Soil Aldehydes" (Paper).—1919.
- SNOOK, HOMER CLYDE.
X-Ray System.—1919.
- SPITZGLASS, JACOB M.
Republic Flow Meter.—1921.
- STAR BRASS MANUFACTURING COMPANY.
Steam Gauge.—1894.
- STEARNS MANUFACTURING COMPANY.
Automatic High Speed Engine.—1892.
- STONE, JOHN STONE.
"Propagation of Electric Waves Along Wires" (Paper).—1913.
- STRADLING, GEORGE F.
"Modern Theories of Magnetism" (Paper).—1916.
- STUMPF, J.
Una Flow Steam Engine.—1909.
- SUCZEK, ROBERT, AND KOTHNY, G. L.
Radojet Air Pump.—1920.
- TAINTOR, C. C.
Positive Saw-Set.—1895.
- TAUSSIG, JOHN H., AND ZEEK, CHARLES F.
Automatic Operation of Water Gas Sets.—1918.
- TEAL, B. F.
Anti-friction Universal Joint for Shafting.—1909.
- THOMAS, C. C.
"Measurement of Gases" (Paper).—1912.
- TIERNAN, MARTIN F., AND WALLACE, C. F.
Chlorinator.—1922.
- TOERRING, C. J.
Electric Arc Lamp.—1903.
- TOWNSEND, T. F.
Improved Thermometer Support.—1907.
- TUCKER, W. H.
Letter and Document Files.—1900.
- TURNER, W. V.
"Locomotive Air-Brake" (Paper).—1911.
- TUTWILER, C. C.
"Recovery of Gas Works by-Products" (Paper).—1915.
- ULRICH, FREDERICK L., AND EBERHARDT, H. E.
Radial-Duplex Gang Cutters.—1904.
- UNDERWOOD, JOHN, AND COMPANY.
Combined Calculating and Typewriting Machine.—1915.

VAN ALLER, TYCHO.

Calorizing Process.—1918.

VAN HORN, WILLIAM H., AND KEMP, WILLIAM W.

Kemp Gas System.—1919.

WAGGNER, B. G.

Prepayment Gas Meter.—1916.

WAGNER ELECTRIC MANUFACTURING COMPANY.

Single Phase Alternating Current Power Motor.—1902.

WAHL ADDING MACHINE COMPANY.

Adding Machine.—1916.

WALLACE, C. F., AND TIERNAN, MARTIN F.

Chlorinator.—1922.

WATERBURY TOOL COMPANY

Double Universal Joint.—1904.

WEIDLOG, CHARLES B.

Indicator for Boring Machines.—1906.

WELSBACH LIGHT COMPANY.

Various Manufactured Products.—1901.

WENTWORTH, C. C.

Improvements in Hydraulic Rams.—1903.

WETHERILL, HENRY EMERSON.

New Physical Diagnostic Instruments.—1906.

WHEELER, GEORGE A.

Step Type Escalator.—1914.

WHITE, J. J.

Journal Box.—1891.

WHITEHEAD, J. B. .

"The Electric Strength of Air and Methods of Measuring High Voltage" (Paper).—1918.

WILLIAMS, BROWN AND EARLE.

Kerosene Lamp for Magic Lanterns.—1902.

WILLIAMS, H. D.; HOADLEY, H. G.; LEWIS, E. C.

Lever and Ratch Attachment.—1900.

WILLIAMSON, E. D., AND ADAMS, L. H.

"The Annealing of Glass" (Paper).—1921.

YAWMAN & ERBE MANUFACTURING COMPANY.

Rapid Roller Copier.—1904.

YOUNG, C. D.

"Locomotive Superheaters" (Paper).—1915.

ZEEK, CHARLES F., AND TAUSSIG, JOHN H.

Automatic Operation of Water Gas Set.—1918.

CERTIFICATE OF MERIT AWARDS

1885-1921.

- BAYLIS, R. N.
Brush Holder and Brusher for Dynamos.—1909.
- BEIN, EMIL J.
Letter and Document Files.—1900.
- BINGHAM, EUGENE C.
Viscometer.—1922.
- BLANTON, E. A., JR.
Shaft Coupling, Nut Locks, Cams, etc.—1910.
- BLONCK, W. A.
Boiler Efficiency Meter.—1914.
- BLOUNT, EUGENE I., AND TAYLOR, WARREN H.
Door Check.—1902.
- BRANCH, C. J.
Electric Light Shade.—1909.
- BULLARD, REAR ADMIRAL W. H. G.
"The Application of Radio to Navigation Problems" (Paper).—1922.
- BYERLY, F. E.
Cutter and Cutter Head.—1893.
- CANDEE, C. H.
Car Truck and Journal Bearings.—1887.
- COOK, J. S.
Self-Lubricating Journal Box.—1898.
- DEMPSTER, J. T. H.; FLEMING, RICHARD; GENERAL ELECTRIC COMPANY; STEIN-
METZ, C. P.
Magnetic Lamp.—1908.
- DERYCKE, J.
Steam Separator.—1894.
- DODGE, W. W.
Wooden Split Pulley.—1885.
- DUNN, G. S.
Automatic Electric Brake Motor.—1902.
- ELLSWORTH, F. G.
The Knudson and Ellsworth Telephone.—1891.
- ELTONHEAD, W. B.
Nut Lock.—1885.
- ETCHELLS, HARRY, AND GREAVES, H. A.
Electric Arc Furnace.—1922.
- FLEMING, RICHARD; DEMPSTER, J. T. H.; GENERAL ELECTRIC COMPANY; STEIN-
METZ, C. P.
Magnetic Lamp.—1908.

- GENERAL ELECTRIC COMPANY; DEMPSTER, J. T. H.; FLEMING, RICHARD; STEINMETZ, C. P.
Magnetic Lamp.—1908.
- GETTY, JOHN K.
Bicycle Support.—1896.
- GILSON, EMERY G.
Calorizing Process.—1918
- GLAZIER, JOHN T. AND PETER F.
Universal Nozzle.—1904.
- GOWDEY, J.
Compartment Drawer.—1902.
- GREAVES, H. A., AND ETCHELLS, HARRY.
Electric Arc Furnace.—1922.
- GREENE, F. V. AND M. A.
Improvement in Windows.—1892.
- HAINES, R. B., JR.
Automatic Micrometer Gauge for Hot Metal.—1896.
- HALLANAN, M.
Horseshoe and Pad.—1896.
- HALLBERG, J. H.
Current System for Trunk Line Railways.—1906.
- HANSON, FREEMAN.
Wood Turning Machine.—1891.
- HARBOLSHEIMER, J.
Garbage Box.—1894.
- HAVARD, OLIVER D.
Coal Meter.—1918.
- HAYS, CHARLES AND JOSEPH.
CO₂ and Draft Recorder.—1920.
- HEPBURN, J. S.; ST. JOHN, E. Q.; JONES, F. M.
"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.
- HILL, EDGAR.
Caliper Measuring Device.—1903.
- HILL, MYRON F.
Roller Bearings.—1902.
- INTERNATIONAL BURGLAR IMMUNITY CO.
Electric Protective Devices.—1905.
- JONES, FRANK MORTON; HEPBURN, J. S.; ST. JOHN, E. Q.
"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.
- KIDDE, WALTER AND COMPANY.
Improved System of Detecting and Extinguishing Marine Fires.—1922.
- KINNEY, R. D.
Internal Fired Water Tube Boiler.—1899.

LANCE, W. L.

Utilizing Oil Cloth Waste.—1888.

LAND, S.

Sash Cord Fastener.—1886.

LANDAU, DAVID, AND PARR, PERCY H.

"A New Theory of Plate Springs" (Paper).—1920.

MCCHESNEY, R.

Improved in T-Squares.—1893.

MACDONALD, THOMAS H.

Apparatus for Recording Sound.—1900.

MCINTYRE COMPANY.

Electric Wire.—1893.

MCLAUTHLIN, MARTIN B., AND TAYLOR, GEORGE.

Household Garbage Carbonizer.—1895.

MENDENHALL, CHARLES E.

"Aeronautic Instruments" (Paper).—1922.

NABER, H. A.

Gas Voltameter.—1895.

NATIONAL NUTRIENT COMPANY.

Nutrium, a new food Product.—1902.

NEUMEYER, H. F.

Spray Nozzle.—1895.

PARR, PERCY H., AND LANDAU, DAVID.

"A New Theory of Plate Springs" (Paper).—1920.

PARVIN, A. B.

Tele-photo Lens.—1895.

PHELPS, W. J.

Hylo-Incandescent Lamp.—1903.

PICH, FRIEDRICH.

Cast Iron Brazing.—1903.

PITNEY, ARTHUR H.

Postage Meter.—1922

REAGAN, JAMES.

Improved Grates.—1900.

RIDGWAY, E. B.

Steam Hydraulic Elevator.—1914.

RINN, J. J.

Tent Fastening.—1904.

ROBINSON, CYRUS R.

Improved Fire Nozzle.—1905.

ROLIN, CHARLES W.

Adjustable and Interchangeable Grate.—1918.

ROWLAND, L. G.

Automatic Safety Device for Electric Circuits.—1897.

- SADTLER, J. P. B.
Water Heater for Range Boilers.—1900.
- SCHENCK, W. T. Y.
Improved Hose Reels.—1893.
- SHEAF, PHILIP A.
Circle Drawing Attachment for Microscopes.—1916.
- SIMPSON, W. L.
Steam Separator.—1894.
- STEIN, F. J.
An Improved and Simplified System of Pitman Phonography.—1904.
- STEINMETZ, C. P.; DEMPSTER, J. T. H.; FLEMING, RICHARD; GENERAL ELECTRIC COMPANY.
Magnetic Lamp.—1908.
- ST. JOHN, E. Q.; HEPBURN, J. S.; JONES, F. M.
Absorption of Nutrients and Allied Phenomena in the Pitchers of the *Sarraceniaceæ*” (Paper).—1921.
- SWEETLAND, ERNEST J.
Metallic Filter Cloth.—1918.
- SWETT AND LEWIS COMPANY.
Static Machine for X-Ray Apparatus.—1899.
- TAYLOR, GEORGE, AND MCLAUTHLIN, MARTIN B.
Household Garbage Carbonizer.—1895.
- TAYLOR, WARREN H., AND BLOUNT, EUGENE I.
Door Check.—1902.
- TUCKFIELD, C. B.
Stove Pipe Anchor.—1896.
- VANIER, G. P.
Potash Bulb.—1914.
- WARDEN, J. T.
Improved Drawing Board.—1893.
- WEBER, GEORGE AND WILLIAM.
Speaking Attachment for Telephone.—1894.
- WHINERY, SAMUEL BRENT.
Improved Method of Blueprinting.—1902.
- WHITE, E. M.
Chimney for Incandescent Lamp.—1898.
- WICKERSHAM, W.
Printers' Quoin.—1894.
- WILKES, M.
Automatic Cut-Off for Slide Valve Engines.—1889.

JOHN SCOTT MEDAL AWARDS

1835-1918.

- ABT, R.
System of Mountain Railways.—1889.
- ACHESON, E. G.
“Carborundum.”—1894.

- ACHESON, E. G.
Artificial Graphite.—1901.
- ADT, J. B.
Tobacco Machine.—1901.
- AKELEY, CARL E.
Cement-Gun.—1916.
- ALBERT, C. F.
Musical Instruments.—1901.
- ALGER, H. C.
Liquid Measurer.—1912.
- ALMOND, T. R.
Angular Coupling.—1892.
- ALMOND, T R.
Flexible Tube.—1897.
- AMERICAN PRISMATIC LIGHT COMPANY.
Light Projecting Glass.—1901.
- ANDERSON, H. N.
Gear Rolling Machine.—1915.
- ANDERSON, LEVI.
File Cutting.—1842.
- ANDERSON, WILLIAM.
Apparatus for Water Purification.—1891.
- ASHFORD, HENRY.
Boat Attaching and Detaching Apparatus.—1883.
- ATKINS, J.
Self-Raking Automatic Reaper and Mower.—1854.
- ATKINSON, J.
Gas Engine.—1889.
- BABBITT, I.
Axle Boxes for Railway Cars.—1840.
- BABBITT, I.
Soft Metal Boxes.—1842.
- BAEKLAND, LEO H.
Bakelite.—1909.
- BAKER, J. G.
Pressure Blower.—1875.
- BALDWIN, F. S.
Caculating Machine.—1874.
- BALDWIN, F. R.
Boiler Tube Cleaner.—1893.
- BALLENTINE, W. I.
Apparatus for Testing Hardness and Density of Metal, etc.—1908.
- BALZER, S. M.
Device for Backing off and Forming Milling Cutters.—1896.
- BARDWELL, JOHN.
Votometer.—1901.

- BASSETT, H.
Compasses.—1835.
- BATCHELLOR, B. C.
Pneumatic Dispatch Tube Apparatus.—1899.
- BATHURST, C. S.
Coin Counting and Wrapping Machine.—1914.
- BATES, ALBERT J.
Improved Corliss Engine.—1895.
- BATES, ROBERT.
Instrument for the Cure of Stammering.—1854.
- BEADLE, C.; BEVAN, E. J.; CROSS, C. F.
Cellulose Products.—1895.
- BEAN, E. W.
Device for Ascertaining Latitude.—1837.
- BECHTOLD, JAMES.
Hollow Handled Cutlery.—1883.
- BECHTOLD, B. A.
High Speed Electric Generators.—1909.
- BEHNS, G. L. H., AND BREMAR, A.
Aspirator for Mill Stones.—1877.
- BEIL, CHEICHESTER A., AND TAINTER, SUMMER.
Apparatus for Recording Sound.—1900.
- BEISWICK, JOSEPH.
Siphon Trap.—1884.
- BEISWICK, JOSEPH.
Knitting Machine.—1892.
- BERKEFIELD, W.
Germ Proof Water Filter.—1893.
- BERLINER, E.
Gramophone.—1897.
- BEVAN, E. J.; BEADLE, C.; CROSS, C. F.
Cellulose Products.—1895.
- BIGGAM, HUGO.
Bevel Gear Cutter.—1887.
- BIGGAM, HUGO.
Gearing for Metal Planners.—1882.
- BILLET, THOMAS.
International Money Machine.—1917.
- BLAKEY, THOMAS W., AND COURTENAY, WILLIAM.
Reconstructed Granite.—1900.
- BLICKENSCHERFER, GEORGE C.
Typewriting Machine. 1901.
- BLODGETT BROTHERS.
Electrical Signal Clock. 1883.
- BLONDEL, ANDRE, AND PAAROWDARI, SPIRIDION.
Holophone Globe.—1898.

- BRADLEY, ANDREW.
Stencil Machine.—1902.
- BRAMWELL, W. C.
Feeding Machine for Fibrous Material.—1894.
- BRANSON, D.; THORNBURGH, R. D.; STARR, J. E.; FULLER, J. E.
Refrigeration Process.—1894.
- BREHMER, HUGO, AND HEYL, HENRY RAND.
Wire Book Sewing Machine.—1883.
- BREMAR, A., AND BEHRNS, G. L. H.
Aspirator for Mill Stones.—1877.
- BRIDGMAN, H. L.
Automatic Ore Sampler.—1893.
- BRILL, J. A.
Convertible Cars, Traction Trucks.—1904.
- BRITTIN, J. W., AND TATHAM, B.
Safety Catch for Elevators.—1875.
- BROWN, EDWARD.
Pyrometers.—1897.
- BROWNING, JOHN M.
Automatic Pistol.—1906.
- BURGER, H. J.
Photo-Polychrome Printing Apparatus.—1903.
- BURRELL, JOHN H., AND METZLER, C. E.
Railway Signal Lantern.—1885.
- BURROUGHS, W. S.
Calculating Machine.—1897.
- BURROWS, AMOS E.
Feed-Water Regulator.—1904.
- BURT, W. A.
Variation Compass.—1835.
- BURTON, G. D.
Electric Forging Device.—1892.
- BURTON, W. L.
Electric Heater.—1890.
- CALAHAN, E. A.
Synchronous Multiplex Telegraphy.—1886.
- CALDERHEAD, A.
Looms.—1840.
- CAMPBELL, P. T., AND C. H.
Apparatus for Reconstructing Milk.—1904.
- CARLETON, CYRUS, AND WILCOX, CHARLES H.
Automatic Tension and Improved Sewing Machines.—1875.
- CARNELL, CHARLES.
Brick Machine.—1850.
- CARNEY, THOS.; COOK, H.; AND PATTERSON, H. G. AND J. H.
Cash Registers.—1901.

- RICHARDS, G. M.
Automatic Fluid Pressure Friction Clutch.—1897.
- RIKER, C. L.
Lavatory.—1900.
- RINGLAND, ALBERT, AND SCHOENFUSS, F. H.
Portable Brinell Meter.—1917.
- ROBY, HENRY W.
Screw Jack.—1891.
- ROEDER, J. R.
Improvement in Windows.—1892.
- ROPER, CHARLES.
Safety Propellers.—1909.
- ROSENDALE BELTING COMPANY.
Camel Hair Belting.—1893.
- ROUSSEL, W. J.
Cipher Code System.—1902.
- RUSBY, J. M.
"Industrial Combustible Gases" (Paper).—1914.
- RUSHTON, K.
Improvements in Trailing Trucks for Locomotives.—1910.
- RUUD, EDWIN.
Instantaneous Automatic Water Heater.—1904.
- SCHEMERHORN, W. GEORGE.
Folding Boat.—1891.
- SCHLINK, FREDERICK J.
Stabilized Platform Weighing Scale.—1919.
- SCHMIDT, MAX, AND SIEBER, JOSEPH.
Movable Sidewalk.—1894.
- SCHMIDT, HENRY J., AND BONNELL, RUSSELL.
Gate Valves.—1901.
- SCHOENFUSS, FRANK H., AND RINGLAND, ALBERT.
Portable Brinell Meter.—1917.
- SCHREINER, O., AND LATHROP, E.
"Organic Constituents in Soils" (Paper).—1912.
- SCRIPTURE, E. W.
Color Sense Tester.—1903.
- SEITZ, HENRY JEROME.
Coal Loading and Screening Machines.—1904.
- SHARPLES, SPECIALTY COMPANY.
Super-Centrifuge.—1916.
- SHAW, H. M.
Lightning Arrester.—1904.
- SHELLENBACH, WILLIAM L.
Variable Speed Countershaft.—1903.
- SHOLES, Z. K.; FAY, C. N.; HOCHKLASSEN, H.
Typewriting Machine.—1901.

- SIEBER, JOSEPH, AND SCHMIDT, MAX E.
Movable Side-Walk.—1894.
- SKINNER, JOSHUA J.
"Soil Aldehydes" (Paper).—1919.
- SNOOK, HOMER CLYDE.
X-Ray System.—1919.
- SPITZGLASS, JACOB M.
Republic Flow Meter.—1921.
- STAR BRASS MANUFACTURING COMPANY.
Steam Gauge.—1894.
- STEARNS MANUFACTURING COMPANY.
Automatic High Speed Engine.—1892.
- STONE, JOHN STONE.
"Propagation of Electric Waves Along Wires" (Paper).—1913.
- STRADLING, GEORGE F.
"Modern Theories of Magnetism" (Paper).—1916.
- STUMPF, J.
Una Flow Steam Engine.—1909.
- SUCZEK, ROBERT, AND KOTHNY, G. L.
Radojet Air Pump.—1920.
- TAINTOR, C. C.
Positive Saw-Set.—1895.
- TAUSSIG, JOHN H., AND ZEEK, CHARLES F.
Automatic Operation of Water Gas Sets.—1918.
- TEAL, B. F.
Anti-friction Universal Joint for Shafting.—1909.
- THOMAS, C. C.
"Measurement of Gases" (Paper).—1912.
- TIERNAN, MARTIN F., AND WALLACE, C. F.
Chlorinator.—1922.
- TOERRING, C. J.
Electric Arc Lamp.—1903.
- TOWNSEND, T. F.
Improved Thermometer Support.—1907.
- TUCKER, W. H.
Letter and Document Files.—1900.
- TURNER, W. V.
"Locomotive Air-Brake" (Paper).—1911.
- TUTWILER, C. C.
"Recovery of Gas Works by-Products" (Paper).—1915.
- ULRICH, FREDERICK L., AND EBERHARDT, H. E.
Radial-Duplex Gang Cutters.—1904.
- UNDERWOOD, JOHN, AND COMPANY.
Combined Calculating and Typewriting Machine.—1915.

VAN ALLER, TYCHO.

Calorizing Process.—1918.

VAN HORN, WILLIAM H., AND KEMP, WILLIAM W.

Kemp Gas System.—1919.

WAGGNER, B. G.

Prepayment Gas Meter.—1916.

WAGNER ELECTRIC MANUFACTURING COMPANY.

Single Phase Alternating Current Power Motor.—1902.

WAHL ADDING MACHINE COMPANY.

Adding Machine.—1916.

WALLACE, C. F., AND TIERNAN, MARTIN F.

Chlorinator.—1922.

WATERBURY TOOL COMPANY

Double Universal Joint.—1904.

WEIDLOG, CHARLES B.

Indicator for Boring Machines.—1906.

WELSBACH LIGHT COMPANY.

Various Manufactured Products.—1901.

WENTWORTH, C. C.

Improvements in Hydraulic Rams.—1903.

WETHERILL, HENRY EMERSON.

New Physical Diagnostic Instruments.—1906.

WHEELER, GEORGE A.

Step Type Escalator.—1914.

WHITE, J. J.

Journal Box.—1891.

WHITEHEAD, J. B. .

"The Electric Strength of Air and Methods of Measuring High Voltage" (Paper).—1918.

WILLIAMS, BROWN AND EARLE.

Kerosene Lamp for Magic Lanterns.—1902.

WILLIAMS, H. D.; HOADLEY, H. G.; LEWIS, E. C.

Lever and Ratch Attachment.—1900.

WILLIAMSON, E. D., AND ADAMS, L. H.

"The Annealing of Glass" (Paper).—1921.

YAWMAN & ERBE MANUFACTURING COMPANY.

Rapid Roller Copier.—1904.

YOUNG, C. D.

"Locomotive Superheaters" (Paper).—1915.

ZEEK, CHARLES F., AND TAUSSIG, JOHN H.

Automatic Operation of Water Gas Set.—1918.

CERTIFICATE OF MERIT AWARDS

1885-1921.

BAYLIS, R. N.

Brush Holder and Brusher for Dynamos.—1909.

BEIN, EMIL J.

Letter and Document Files.—1900.

BINGHAM, EUGENE C.

Viscometer.—1922.

BLANTON, E. A., JR.

Shaft Coupling, Nut Locks, Cams, etc.—1910.

BLONCK, W. A.

Boiler Efficiency Meter.—1914.

BLOUNT, EUGENE I., AND TAYLOR, WARREN H.

Door Check.—1902.

BRANCH, C. J.

Electric Light Shade.—1909.

BULLARD, REAR ADMIRAL W. H. G.

"The Application of Radio to Navigation Problems" (Paper).—1922.

BYERLY, F. E.

Cutter and Cutter Head.—1893.

CANDEE, C. H.

Car Truck and Journal Bearings.—1887.

COOK, J. S.

Self-Lubricating Journal Box.—1898.

DEMPSTER, J. T. H.; FLEMING, RICHARD; GENERAL ELECTRIC COMPANY; STEIN-METZ, C. P.

Magnetic Lamp.—1908.

DERYCKE, J.

Steam Separator.—1894.

DODGE, W. W.

Wooden Split Pulley.—1885.

DUNN, G. S.

Automatic Electric Brake Motor.—1902.

ELLSWORTH, F. G.

The Knudson and Ellsworth Telephone.—1891.

ELTONHEAD, W. B.

Nut Lock.—1885.

ETCHELLS, HARRY, AND GREAVES, H. A.

Electric Arc Furnace.—1922.

FLEMING, RICHARD; DEMPSTER, J. T. H.; GENERAL ELECTRIC COMPANY; STEIN-METZ, C. P.

Magnetic Lamp.—1908.

GENERAL ELECTRIC COMPANY; DEMPSTER, J. T. H.; FLEMING, RICHARD; STEIN-METZ, C. P.

Magnetic Lamp.—1908.

GETTY, JOHN K.

Bicycle Support.—1896.

GILSON, EMERY G.

Calorizing Process.—1918

GLAZIER, JOHN T. AND PETER F.

Universal Nozzle.—1904.

GOWDEY, J.

Compartment Drawer.—1902.

GREAVES, H. A., AND ETCHHELLS, HARRY.

Electric Arc Furnace.—1922.

GREENE, F. V. AND M. A.

Improvement in Windows.—1892.

HAINES, R. B., JR.

Automatic Micrometer Gauge for Hot Metal.—1896.

HALLANAN, M.

Horseshoe and Pad.—1896.

HALLBERG, J. H.

Current System for Trunk Line Railways.—1906.

HANSON, FREEMAN.

Wood Turning Machine.—1891.

HARBOLSHEIMER, J.

Garbage Box.—1894.

HAVARD, OLIVER D.

Coal Meter.—1918.

HAYS, CHARLES AND JOSEPH.

CO₂ and Draft Recorder.—1920.

HEPBURN, J. S.; ST. JOHN, E. Q.; JONES, F. M.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

HILL, EDGAR.

Caliper Measuring Device.—1903.

HILL, MYRON F.

Roller Bearings.—1902.

INTERNATIONAL BURGLAR IMMUNITY CO.

Electric Protective Devices.—1905.

JONES, FRANK MORTON; HEPBURN, J. S.; ST. JOHN, E. Q.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

KIDDE, WALTER AND COMPANY.

Improved System of Detecting and Extinguishing Marine Fires.—1922.

KINNEY, R. D.

Internal Fired Water Tube Boiler.—1899.

LANCE, W. L.

Utilizing Oil Cloth Waste.—1888.

LAND, S.

Sash Cord Fastener.—1886.

LANDAU, DAVID, AND PARR, PERCY H.

"A New Theory of Plate Springs" (Paper).—1920.

McCHESNEY, R.

Improved in T-Squares.—1893.

MACDONALD, THOMAS H.

Apparatus for Recording Sound.—1900.

McINTYRE COMPANY.

Electric Wire.—1893.

McLAUTHLIN, MARTIN B., AND TAYLOR, GEORGE.

Household Garbage Carbonizer.—1895.

MENDENHALL, CHARLES E.

"Aeronautic Instruments" (Paper).—1922.

NABER, H. A.

Gas Voltameter.—1895.

NATIONAL NUTRIENT COMPANY.

Nutrium, a new food Product.—1902.

NEUMEYER, H. F.

Spray Nozzle.—1895.

PARR, PERCY H., AND LANDAU, DAVID.

"A New Theory of Plate Springs" (Paper).—1920.

PARVIN, A. B.

Tele-photo Lens.—1895.

PHELPS, W. J.

Hylo-Incandescent Lamp.—1903.

PICH, FRIEDRICH.

Cast Iron Brazing.—1903.

PITNEY, ARTHUR H.

Postage Meter.—1922

REAGAN, JAMES.

Improved Grates.—1900.

RIDGWAY, E. B.

Steam Hydraulic Elevator.—1914.

RINN, J. J.

Tent Fastening.—1904.

ROBINSON, CYRUS R.

Improved Fire Nozzle.—1905.

ROLIN, CHARLES W.

Adjustable and Interchangeable Gate.—1918.

ROWLAND, L. G.

Automatic Safety Device for Electric Circuits.—1897.

- SADTLER, J. P. B.
Water Heater for Range Boilers.—1900.
- SCHENCK, W. T. Y.
Improved Hose Reels.—1893.
- SHEAF, PHILIP A.
Circle Drawing Attachment for Microscopes.—1916.
- SIMPSON, W. L.
Steam Separator.—1894.
- STEIN, F. J.
An Improved and Simplified System of Pitman Phonography.—1904.
- STEINMETZ, C. P.; DEMPSTER, J. T. H.; FLEMING, RICHARD; GENERAL ELECTRIC COMPANY.
Magnetic Lamp.—1908.
- ST. JOHN, E. Q.; HEPBURN, J. S.; JONES, F. M.
Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.
- SWEETLAND, ERNEST J.
Metallic Filter Cloth.—1918.
- SWETT AND LEWIS COMPANY.
Static Machine for X-Ray Apparatus.—1899.
- TAYLOR, GEORGE, AND McLAUTHLIN, MARTIN B.
Household Garbage Carbonizer.—1895.
- TAYLOR, WARREN H., AND BLOUNT, EUGENE I.
Door Check.—1902.
- TUCKFIELD, C. B.
Stove Pipe Anchor.—1896.
- VANIER, G. P.
Potash Bulb.—1914.
- WARDEN, J. T.
Improved Drawing Board.—1893.
- WEBER, GEORGE AND WILLIAM.
Speaking Attachment for Telephone.—1894.
- WHINERY, SAMUEL BRENT.
Improved Method of Blueprinting.—1902.
- WHITE, E. M.
Chimney for Incandescent Lamp.—1898.
- WICKERSHAM, W.
Printers' Quoin.—1894.
- WILKES, M.
Automatic Cut-Off for Slide Valve Engines.—1889.

JOHN SCOTT MEDAL AWARDS

1835-1918.

- ABT, R.
System of Mountain Railways.—1889.
- ACHESON, E. G.
"Carborundum."—1894.

- ACHESON, E. G.
Artificial Graphite.—1901.
- ADT, J. B.
Tobacco Machine.—1901.
- AKELEY, CARL E.
Cement-Gun.—1916.
- ALBERT, C. F.
Musical Instruments.—1901.
- ALGER, H. C.
Liquid Measurer.—1912.
- ALMOND, T. R.
Angular Coupling.—1892.
- ALMOND, T. R.
Flexible Tube.—1897.
- AMERICAN PRISMATIC LIGHT COMPANY.
Light Projecting Glass.—1901.
- ANDERSON, H. N.
Gear Rolling Machine.—1915.
- ANDERSON, LEVI.
File Cutting.—1842.
- ANDERSON, WILLIAM.
Apparatus for Water Purification.—1891.
- ASHFORD, HENRY.
Boat Attaching and Detaching Apparatus.—1883.
- ATKINS, J.
Self-Raking Automatic Reaper and Mower.—1854.
- ATKINSON, J.
Gas Engine.—1889.
- BABBITT, I.
Axle Boxes for Railway Cars.—1840.
- BABBITT, I.
Soft Metal Boxes.—1842.
- BAEKLAND, LEO H.
Bakelite.—1909.
- BAKER, J. G.
Pressure Blower.—1875.
- BALDWIN, F. S.
Caculating Machine.—1874.
- BALDWIN, F. R.
Boiler Tube Cleaner.—1893.
- BALLENTINE, W. I.
Apparatus for Testing Hardness and Density of Metal, etc.—1908.
- BALZER, S. M.
Device for Backing off and Forming Milling Cutters.—1896.
- BARDWELL, JOHN.
Votometer.—1901.

- BASSETT, H.
Compasses.—1835.
- BATCHELLOR, B. C.
Pneumatic Dispatch Tube Apparatus.—1899.
- BATDORF, C. S.
Coin Counting and Wrapping Machine.—1914.
- BATES, ALBERT J.
Improved Corliss Engine.—1895.
- BATES, ROBERT.
Instrument for the Cure of Stammering.—1854.
- BEADLE, C.; BEVAN, E. J.; CROSS, C. F.
Cellulose Products.—1895.
- BEAN, E. W.
Device for Ascertaining Latitude.—1837.
- BEECHER, JAMES.
Hollow Handled Cutlery.—1883.
- BEHREND, B. A.
High Speed Electric Generators.—1909.
- BEHRNS, G. L. H., AND BREMAR, A.
Aspirator for Mill Stones.—1877.
- BELL, CHICHESTER A., AND TAINTER, SUMMER.
Apparatus for Recording Sound.—1900.
- BENNOR, JOSEPH.
Siphon Trap.—1884.
- BENNOR, JOSEPH.
Knitting Machine.—1892.
- BERKEFELD, W.
Germ Proof Water Filter.—1893.
- BERLINER, E.
Gramophone.—1897.
- BEVAN, E. J.; BEADLE, C.; CROSS, C. F.
Cellulose Products.—1895.
- BILGRAM, HUGO.
Bevel Gear Cutter.—1887.
- BILGRAM, HUGO.
Gearing for Metal Planners.—1882.
- BILYEU, THOMAS.
International Money Machine.—1917.
- BLAKEY, THOMAS W., AND COURTENAY, WILLIAM.
Reconstructed Granite.—1900.
- BLICKENSDEFFER, GEORGE C.
Typewriting Machine. 1901.
- BLODGETT BROTHERS.
Electrical Signal Clock.—1883.
- BLONDEL, ANDRE, AND PAAROWDAKI, SPIRIDION.
Holophone Globes.—1898.

- BRADLEY, ANDREW.
Stencil Machine.—1902.
- BRAMWELL, W. C.
Feeding Machine for Fibrous Material.—1894.
- BRANSON, D.; THORNBURGH, R. D.; STARR, J. E.; FULLER, J. E.
Refrigeration Process.—1894.
- BREHMER, HUGO, AND HEYL, HENRY RAND.
Wire Book Sewing Machine.—1883.
- BREMAR, A., AND BEHRNS, G. L. H.
Aspirator for Mill Stones.—1877.
- BRIDGMAN, H. L.
Automatic Ore Sampler.—1893.
- BRILL, J. A.
Convertible Cars, Traction Trucks.—1904.
- BRITTIN, J. W., AND TATHAM, B.
Safety Catch for Elevators.—1875.
- BROWN, EDWARD.
Pyrometers.—1897.
- BROWNING, JOHN M.
Automatic Pistol.—1906.
- BURGER, H. J.
Photo-Polychrome Printing Apparatus.—1903.
- BURRELL, JOHN H., AND METZLER, C. E.
Railway Signal Lantern.—1885.
- BURROUGHS, W. S.
Calculating Machine.—1897.
- BURROWS, AMOS E.
Feed-Water Regulator.—1904.
- BURT, W. A.
Variation Compass.—1835.
- BURTON, G. D.
Electric Forging Device.—1892.
- BURTON, W. L.
Electric Heater.—1890.
- CALAHAN, E. A.
Synchronous Multiplex Telegraphy.—1886.
- CALDERHEAD, A.
Looms.—1840.
- CAMPBELL, P. T., AND C. H.
Apparatus for Reconstructing Milk.—1904.
- CARLETON, CYRUS, AND WILCOX, CHARLES H.
Automatic Tension and Improved Sewing Machines.—1875.
- CARNELL, CHARLES.
Brick Machine.—1850.
- CARNEY, THOS.; COOK, H.; AND PATTERSON, H. G. AND J. H.
Cash Registers.—1901.

- CARROLL, W. T.
Non-Metallic Bearings.—1896.
- CASTNER, H. Y.
Apparatus for the Manufacture of Sodium and Potassium.—1889.
- CERASOLI, ALBERTO, AND HUMPHREY, H. A.
Hydraulic Pump.—1914.
- CHABOT, CYPRIEN.
Shoe Sole Channelling Machine.—1885.
- CHABOT, CYPRIEN.
Shoe Sewing Machine.—1885.
- CHABOT, CYPRIEN.
Shoe Sole Edge Turning Machine.—1885.
- CHABOT, CYPRIEN.
Beveled Rim Watch Cases.—1886.
- CHAMBERS, C.
Brick Machine.—1875.
- CHAMBERS, C.
Book Folding and Pasting Machine.—1874.
- CHAUVENET, WILLIAM.
Great Circle Protractor.—1857.
- CHENOWETH, A. C.
Electric Conduits.—1890.
- CHENOWETH, A. C.
Steel Concrete Foundation Piles.—1906.
- CLARK, G. S.
Device for Safety Vaults.—1892.
- CLAUD, G. M.; HESS, G. A.; FOUCHE, EDMUND.
Process of Storing Explosive Gases.—1903.
- CLEBORNE, C. J.
Bedstead.—1894.
- COLBY, E. A.
Electric Furnace for Melting Metals.—1909.
- COLTON, SABIN W.
Improved Locks.—1848.
- CONNET, FREDERICK N., AND JACKSON, W. W.
Improved Venturi Meter.—1898.
- COOK, H.; CARNEY, T.; PATTERSON, H. G. & J. H.
Cash Registers.—1901.
- COOPER, DANIEL.
Time Recorder.—1898.
- COURTENAY, WILLIAM, AND BLAKEY, THOMAS W.
Reconstructed Granite.—1900.
- COWLES, EUGENE H., AND ALFRED H.
Electric Smelting Furnace.—1887.
- COWPER-COWLES, SHERARD.
Method of Depositing Metals on Metallic Surfaces.—1911.

- CREHORE, A., AND SQUIER, G. O.
Polarizing Photo-Chronograph.—1896.
- CROSS, C. F.; BEADLE, CLAYTON; BEVAN, E. J.
Cellulose Products.—1895.
- CROSS, W. A.
Horizontal Folding Door.—1903.
- CYCLOSTYLE COMPANY.
Cyclostyle.—1888.
- DALE, JOHN D.
Wood Molding Machine.—1857.
- DARLING, J. D.
Apparatus for Producing Metals and Nitric Acid from Fused Nitrates.—1901.
- DAVIS, JOB A.
Vertical Feed for Sewing Machine.—1875.
- DENISON, L. C.
Corn Sheller.—1839.
- DIETZ, GUSTAV.
High Speed Photographic Between-lens Shutter.—1909.
- DILKS, J.
Water Gauges.—1853.
- DOBBINS, E. J.
Daylight Rod.—1914.
- DOBBINS, EDWARD J., AND MOFFETT, GEORGE.
Light Projecting Glass.—1901.
- DOBLE, W. A.
Tangential Water Wheel.—1904.
- DOCK, H.
Rivett Thread Tool.—1901.
- DODGE, J. M.
Storage Structure for Coal and Analogous Material.—1904.
- DODGE, WALLACE H.
System of Rope Transmission.—1891.
- DOERR, JOHN H., AND WIGMORE, WILLIAM H.
Sleeping Car.—1885.
- DORR, JOHN V. H.
Hydrometallurgical Apparatus.—1916.
- DOWNES, L. W.
Fireproof Insulated Wire.—1905.
- DRESSLER, CONRAD D'HUC.
Tunnel Kiln.—1918.
- DUNCAN, JOSEPH S.
Addressograph.—1903.
- DUNHAM, JOSEPH M., AND MCKEMMIL, JOHN.
Metallic Drawing Rolls.—1894.
- DUNN, B. W.
Testing Machine for Measuring Intensities of Impulsive Forces.—1898.

- DURKEE, G. B., AND GOLDING, JOHN F.
Expanded Metal.—1897.
- DUTTON, R. & Co.
Mowing Machine.—1877.
- ECKSTEIN, H. G.
Feed Water Heater.—1884.
- EDISON, T. A.
Mimeograph.—1889.
- EDSON, J. B.
Pressure Recording Gauge.—1894.
- EHBETS, C. J.
Improved Revolver.—1890.
- ELDRED, BYRON E.
Process for Flame Regulation.—1906.
- ELDRIDGE, G. M.
Electro Magnetic Protector for Electric Instruments.—1884.
- ELLIS, H.
Combined Calculating and Writing Machine.—1909.
- ELMER AND LITTLE.
Chronometer.—1837.
- EMERSON, J.
Power Scale.—1892.
- EWBANK, T.
Lead Pipes.—1835.
- FABER, GEORGE.
Magnetic Water Gage.—1853.
- FAHY, FRANK P.
Permeameter.—1918.
- FAWKES, JOSEPH W.
Steam Plow.—1859.
- FELLOWS, E. R.
Machine and Cutter for Generating Gear Teeth.—1899.
- FELT, D. E.
Comptometer.—1890.
- FIELD, D. W., AND SPENCER, JOHN E.
Damper Regulator.—1893.
- FISHER, ROBERT T.
Improved Book and Letter Typewriter.—1899.
- FORTEN, R. B.
Telescope.—1840.
- FOUCHE, E.; CLAUD, G. M. A.; HESS, G. M.
Process for Storing Explosive Gases.—1902.
- FRAHM, HERMANN.
Speed Indicator, Frequency Teller and Revolution Counter.—1907.
- FRANCIS, JEROME B.
Tooth Extractor.—1860.

FRAZER, PERSIFOR.

Apparatus for Quantitative Colorimetry.—1905.

FULLER, FRED L., AND GRISWOLD, GEORGE H.

Cash Register and Indicator.—1892.

FULLER, J. E.; BRANSON, D.; THORNBURGH, R. D.; STARR, J. E.

Refrigeration Process.—1894.

FURBISH, ZACHARY T.

Ratchet Tools.—1904.

GARROD, R. P.

Annunciators.—1891.

GATES, JOHN.

Lubricator.—1888.

GIBBONS, C. L.

Street Railway Construction.—1892.

GILLESPIE, ALFRED J.

Voting Machine.—1902.

GLIDDENS, CARLOS; SHOLES, C. L.; SOULE, S. W.

Improved Typewriter.—1875.

GODDARD, K.

Carriage Axle.—1852.

GOETZ, G. M.

Device for Anchoring Beams.—1891.

GOLDBERG, H. E., AND WAHL, J. C.

Adding Machine.—1916.

GOLDING, J. F., AND DURKEE, G. B.

Expanded Metal.—1897.

GOLDSTEIN, A.

Pneumatic Fire Alarm Telegraph System.—1895.

GOODES, E. A.

Sewing Machine.—1875.

GOODWIN, WILLIAM FARR.

Mowing Machine.—1879.

GOODYEAR, ROBERT B.

Harness Motion for Power Looms.—1875.

GOODYEAR, ROBERT B.

Shuttle Box Operating Mechanism.—1875.

GRANT, GEORGE B.

Calculating Machine.—1877.

GRANT, GEORGE B.

Calculating Machine.—1896.

GRAU, PHILIP J.

Feed Water Purifier and Heater.—1886.

GREENE, E. V.

Apparatus for Extracting Oil and Albuminoid from Corn.—1851.

GRIMES, W. C.

Water Gauge for Steam Boilers.—1851.

- GRIMES, W. C.
Smut Machine.—1840.
- GRISWALD, GEORGE H., AND FULLER, FRED L.
Cash Register and Indicator.—1892.
- GROUPE, A. V.
Braiding Machine.—1900.
- GUILLAUME, C. E.
Invar Alloy.—1914.
- HADFIELD, ROBERT.
Manganese Steel.—1891.
- HAHL, A. L.
Pneumatic Clock.—1901.
- HAINES, ROBERT B., JR.
Automatic Micrometer Rolling Mill Plate Gauge.—1901.
- HAKEWESSEL, REINHOLD, AND HENN, EDWIN C.
Automatic Screw and Metal Working Machine.—1901.
- HALL, THOMAS.
Typewriter.—1884.
- HALL, M. W.
Duplex Steam Pump.—1886.
- HALLOCK, DAVID.
Weighing Scale.—1887.
- HALLOWELL, HOWARD T.
Pressed Steel Shaft Hangers.—1906.
- HAMMER, WILLIAM J.
Apparatus for Long Distance Phonographic and Telephonic Experiments.—1902.
- HANNAY, J. B., AND SHEDLOCK, ALFRED.
Lucigen.—1891.
- HANSON, HANS, AND HART, FREDERICK A.
Calculating and Typewriting Machine.—1915.
- HARDINGE, H. W.
Conical Pebble Mill.—1915.
- HARO, A LOPEX DE.
Electric Sea Compass; Automatic Electric Log Line.—1890.
- HART, EDWARD.
Acid Container.—1891.
- HART, FREDERICK A., AND HANSON, HANS.
Combined Calculating and Typewriting Machine.—1915.
- HART, WALTER.
Hoisting Machine.—1891.
- HEANY, J. A.
Enclosed Arc Lamp.—1904.
- HECTROTTE, A. G.
Car Couping.—1848.
- HELLINGS, J.
Mail Bag Fastener.—1890.

- HENN, E. C., AND HAKEWESSEL, REINHOLD.
Automatic Screw and Metal Working Machine.—1901.
- HERAEUS, W. C.
Fused Quartz Mercury Lamp.—1906.
- HERAEUS, W. E.
Improvements on the LeChatelier Pyrometer.—1907.
- HERMAN, HENRY O.
Star Ventilator.—1902.
- HERR, H. A.
Liquid Extraction Apparatus.—1909.
- HESS, G. A., CLAUD, G. M. A., FOUCHE, E.
Process of Storing Explosive Gases.—1902.
- HEXAMER, C. J.
Apparatus for Preventing and Extinguishing Fires in Grinding Mills.—1888.
- HEYL, HENRY R., AND BREHMER, HUGO.
Wire Book Sewing Machine.—1883.
- HEYL, HENRY R.
Wire Fastened Paper Boxes.—1875.
- HIGGINS, A., AND JACOBS, C. B.
Alundum Refractories.—1909.
- HILL, T.
Calculating Instrument.—1843.
- HOBSON, A. E.
Hydraulic Shaping Press.—1890.
- HOLCOMB, A.
Reflecting Telescope.—1835.
- HOPKINS, EDWARD P.
Electric Arc Lamp.—1896.
- HOPKINS, N. M.
Pneumatic Water Pipe Cushioning.—1900.
- HOUGH, JAMES, AND LAUGHLIN, SAMUEL.
Drawing Tables.—1900.
- HUMPHREY, F. A.
Improved Sawing Machine and Guide.—1901.
- HUMPHREY, H. A., AND CERASOLI, ALBERTO.
Hydraulic Pump.—1914.
- HUTCHINS AND MABBITT.
Tilting Chair.—1875.
- HYATT, I. S.
Purification of Water System.—1888.
- HYATT, J. W.
Roller Bearings.—1898.
- IHLDER, J. D.; SMITH, A. C.; SUNDH, AUGUST; OTIS, SIDNEY.
Electric Elevator.—1902.
- IRWIN, JOHN H.
Lantern.—1873.

- IVES, FREDERICK E.
Isochromatic Photography.—1887.
- IVES, FREDERICK E.
Projecting Lantern and Appurtenances.—1890.
- IVES, FREDERICK E.
Parallax Stereogram.—1904.
- IVES, FREDERICK E.
New Form of Replica of Rowland Diffraction Grating.—1905.
- IVES, FREDERICK E.
Color Meter.—1907.
- JACKSON, WALTER W., AND CONNET, F. N.
Improved Venturi Meter.—1898.
- JACOBS, C. B., AND HIGGINS, A. C.
Alundum Refractories.—1909.
- JANDUS, WILLIAM.
Enclosed Arc Lamp.—1895.
- JAY, PERRIE EGMOND.
Automatic Anti-Freezing Valve.—1885.
- JENKINS, C. F.
Motion Pictures Apparatus.—1909.
- JENKS, W.
Fire Arms.—1840.
- JEWELL, M. R.; POWERS, T. B.; KELLY, J. F.
Teleelectric Piano Player.—1910.
- JOHNSON, A. L.
Bonding Joint for Electric Railways.—1896.
- JOHNSON, E. H.
Interior Electric House Conduit.—1891.
- JONES, ALFRED C.
Shaft Couplings.—1842.
- JONES, EVAN W.
Underfeed Mechanical Stoker.—1904.
- JONES, H. P.
Baling Machine.—1901.
- JONES, J. R.
Method of and Apparatus for Axle Rolling.—1892.
- KELLY, J. F.; POWERS, T. B.; JEWELL, M. R.
Teleelectric Piano Player.—1910.
- KEMBLE, B. H.
Wheel Hubs.—1883.
- KENT, A. ATWATER.
Ignition System for Automobiles.—1914.
- KITE, J. S.
Safety Beam.—1840.
- KNEASS, S. L.
Injector.—1901.

- KOYL, C. H.
Parabolic Semaphore.—1889.
- KURTZ, DAVID T.
Cap Screws and Bolts—1905.
- LA RUE, S. H.
Stove for Soft or Bituminous Coal.—1893.
- LATTIG, J. W.
Automatic Electric Semaphore Signal.—1904.
- LAUGHLIN, SAMUEL, AND HOUGH, JAMES.
Drawing Tables.—1900.
- LECLERE, FRANCIS.
Black Printing Process.—1897.
- LECLERE, FRANCIS.
Toothed Gear Wheel—1891.
- LEONARD, H. W.
System of Motor Control.—1902.
- LEVY, M. AND L. E.
Screens for Photo-Mechanical Engraving.—1897.
- LEWIS, WILFRED; TABOR, HARRIS; MUMFORD, E.
Molding Machine.—1902.
- LINCOLN, P. M.
Synchronism Indicator.—1902.
- LITTLE AND ELMER.
Chronometer.—1837.
- LOSS, HENRIK V.
Solid Steel Railway Wheels Manufactured by Hydraulic Forging with Rolling.—1904.
- LOVEKIN, L. D.
Device for Relieving Forces due to Inertia and Weight of Valve Gears.—1910.
- LOWE, J.
Spinning Mule.—1890.
- LUNGREN, CHARLES M.
Incandescent Gas Light.—1892.
- MACCOY, J. S.
Pneumatic Tool.—1890.
- MCCALL, THOMAS A., AND PILLINGS, JOHN H.
Automatic Typewriter.—1917.
- MCCAULEY, THOMAS, AND REED, C. J.
Speed-Jack.—1907.
- MCCLELLAN, EZRA S.
Anti-Siphon Vent.—1892.
- MCCRACKEN, EDWIN D.
Insulated Electrical Conductors.—1896.
- MCINTIRE, C.
Electric Wire Connectors.—1890.

- McKEE, M. A.
Process of Treating Printing Plates.—1912.
- McKEMMIL, JOHN, AND DUNHAM, JOSEPH M.
Metallic Drawing Rolls.—1894.
- McMAHAN, J.
Stereotyping Plate.—1835.
- McMULLEN, JOHN.
Machine for Knitting Stockings.—1835.
- MACHLET, GEORGE, AND REICHHELM, E. P.
Apparatus for Producing Fuel Gas.—1894.
- McCURDY, ARTHUR W.
Apparatus for Developing Photographic Roll Prints.—1904.
- MADDOX, R. L.
Substitution of Gelatine for Collodion in Photography.—1889.
- MAHAN, FRANCIS.
Measure Case Ruler.—1837.
- MARCY, L. J.
Magic Lantern.—1887.
- MARKS, A. A.
Artificial Limbs.—1889.
- MARSDEN, M.
Corn-pith Cellulose.—1896.
- MASON, A. J.
Washer Punching Machine.—1891.
- MELLOR, L. B.
Device for Measuring and Recording the Variable Diameter of Tubes.—1903.
- MERGENTHALER, O.
Linotype.—1889.
- MERKET, LUZERNE, AND THOMAS, ALMER.
Tempered Copper.—1891.
- MERRICK AND TOWNE.
Boring Machine.—1840.
- MERSHON, R. D.
Compensated Potential Indicator.—1901.
- METZLER, CHRISTIAN E., AND BURRELL, JOHN H.
Railway Signal Lantern.—1885.
- MEYERS, J. G.
Mausoleum.—1889.
- MEYLAN, EUGENE, AND RECKNIEWSKI, CAMILLE S.
Electric Meter.—1893.
- MILLER, D. K.
Self Locking Padlock.—1883.
- MILLIAU, EDWARD.
Apparatus for Analyzing Fats and Oils.—1896.
- MOFFETT, GEORGE, AND DOBBINS, EDWARD J.
Light Projecting Glass.—1901.

- MOORE, D. MCFARLAN.
Vacuum-tube Light.—1909.
- MOORE, LEE C.
Wire Testing Machine.—1904.
- MORRIS, HENRY G., AND SALOM, PEDRO G.
Electric Automobile.—1897.
- MORSE, EVERETT F.
Heat Gage.—1903.
- MORSE, EVERETT F.
Drive Chains.—1901.
- MORSELL, W. F. C.
Complementary Color Designs and Crystal Patterns.—1894.
- MOSER, L.
"Bohemian" Glassware.—1886.
- MOSKOWITZ, MORRIS.
System of Car Lighting.—1900.
- MUELLER, H. C.
Apparatus and Process for Manufacturing Mosaics.—1898.
- MUMFORD, EDGAR; LEWIS, WILFRED; TABOR, H.
Molding Machine.—1902.
- NACKE, ARNOLD.
Screw Cutting Attachment.—1883.
- NAGLEE, H. M.
Flat Bar or Edge Rail for Railroad Curves.—1842.
- NERNST LAMP COMPANY.
Incandescent Lamp.—1906.
- NICHOLS, H. B., AND VOYNOW, C. B.
Cast Zinc Joint for Rail-Bonding.—1906.
- OLDS, CALVIN.
Planting Machine.—1840.
- ORUM, MORRIS L.
Improved Lock.—1885.
- ORUM, MORRIS L.
Mandrel for Bending Metal Pipes.—1875.
- OTIS, SIDNEY; SMITH, R. C.; IHLDER, J. D.; SUNDH, AUGUST.
Electric Elevator.—1902.
- OUTERBRIDGE, A. E., JR.
Method of Carbonizing Fabrics and Castings Therefrom.—1888.
- OUTERBRIDGE, A. E., JR.
Method for Investigating the Molecular Physics of Cast Iron.—1897.
- PAAROWDAKI, SPIRIDION, AND BLONDEL, ANDRE.
Holophone Globes.—1898.
- PALMER, B. F.
Artificial Leg.—1849.
- PALMER, FREDERICK; REYNOLDS, J. R.; TIRRELL, J. P.
Engine Stop and Speed Limit System.—1906.

- PARKER, ZEBULON.
Water Wheel.—1847.
- PARKINSON, EDWARD.
Knitting Machine.—1905.
- PARSONS, L. H.
Scale Measure.—1852.
- PATTERSON, H. G.; PATTERSON, J. G.; CARNEY, T.; COOK, H.
Cash Registers.—1901.
- PATTERSON, J. G.; PATTERSON, H. G.; CARNEY, T.; COOK, H.
Cash Registers.—1901.
- PAYEN, C.
Chloride Electrical Storage Battery.—1894.
- PEALE, F.
Coining Presses at the United States Mint, Philadelphia.—1840.
- PENTZ, A. D.
Boring and Milling Engine.—1891.
- PERRY, N. W.
Method of Series Electric Traction.—1894.
- PFATISCHER, MATTHIAS.
Variable Speed Motors.—1909.
- PHELPS, L. J.
Induction Telegraph.—1886.
- PHOENIX IRON COMPANY.
Automatic Cut-Off Steam Engine.—1886.
- PILLINGS, JOHN H., AND MCCALL, THOMAS A.
Automatic Typewriter.—1917.
- PONTRICHET, J.
"Heliographic" Paper.—1894.
- POOLE AND COMPANY, J. MORTON.
Grinding Metallic Calendar Rolls.—1875.
- POWERS, T. B.; JEWELL, M. R.; KELLY, J. F.
Teleelectric Piano Player.—1910.
- PRATT AND WHITNEY COMPANY.
Taps and Gauges.—1883.
- PRATT AND WHITNEY COMPANY.
System of Interchangeable Cut Gears.—1886.
- PRENTISS, H. S.
Automatic Calendar.—1896.
- PRIESTMAN, W. D. AND SAMUEL.
Steam Engine.—1894.
- PRUNTY, JOHN E.
Relief Valve.—1875.
- PRUTZMAN, A.
Door Lock.—1836.
- REAGAN, J.
Grate Bars.—1908.

- RECEVEUR, P. N.
Rose Engine (Lathe).—1853.
- RECKNIIEWSKI, CAMILLE, AND MEYLAN, EUGENE.
Electric Meter.—1893.
- REDDAWAY, FRANK.
Camel Hair Belting.—1898.
- REED, CHARLES J., AND McCAULEY, THOMAS.
Speed-Jack.—1906.
- REICHHELM, E. P., AND MACHLET, GEORGE.
Apparatus for Producing Fuel Gases.—1894.
- RENO, J. W.
Escalator.—1910.
- REYNOLDS, J. R.; PALMER, FREDERICK, S.; TIRRELL, J. P.
Engine Stop and Speed Limit System.—1906.
- RHOADS, J.
Map for the Blind.—1840.
- RICHARDS, J.
Solder for Aluminum.—1896.
- RICHARDS, J.
Balance for Testing White Metal Alloys.—1901.
- RICHARDS, T. A.
Ruling Machine.—1890.
- RICHARDSON.
Eccentric Door Spring.—1840.
- RICHARDSON, J. H.
Signal Lantern.—1868.
- RIDGWAY, T. S., JR.
Transit Theodolite.—1839.
- RIDGWAY, W. H.
Balanced Crane.—1890.
- RIEFLE, SIGMUND.
Mercurial Compensation Pendulum.—1894.
- RITCHIE, E. S.
Improved Rhumkorff Coil.—1860.
- rites, F. M.
Perfecting of Shaft Governor System.—1902.
- ROEDER, F. A., AND SPRINGER, ALFRED.
Torsion Balance.—1891.
- RONDINELLA, L. F.
Photo-Printing Machine.—1905.
- Root, J. B.
Spiral Weld Tubing.—1890.
- ROOTS, P. H. AND F. M.
Rotary Pressure Blower.—1875.
- RORER, T. J.
Belting.—1875.

- ROSENBAUM, WALTER A.
Automatic Hydraulic Letter Copying Press.—1905.
- SACHS, J.
Enclosed Fuse Protective Devices.—1903.
- SALOM, PEDRO G., AND MORRIS, HENRY G.
Electric Automobile.—1897.
- SARGENT, C. E.
Expansion Gas Engine.—1907.
- SAYEN, H. L.
Improved Roentgen Ray Tubes.—1898.
- SAXTON, J.
Reflecting Pyrometer.—1842.
- SCHELLENBACH, WILLIAM S.
System of Gearing.—1902.
- SCHMIDT, M. E.
Moving Platform.—1906.
- SCHOOP, MAX ULRICH.
Metal Spraying Process.—1917.
- SEE, H.
Hydro-Pneumatic Ash Ejector.—1904.
- SEMPLE, J. B.
Shell Torch or Tracer.—1905.
- SENNEFF, JACOB.
Eye-Harness for Metallic Heddle.—1853.
- SEVERY, M. L.
Printing Machine.—1898.
- SEYMOUR, C.
Balancer for Pulleys, Fly Wheels, etc.—1878.
- SEXTON, A.
Slide Rule.—1899.
- SHAW, T.
Instrument for Testing Ignitable Gases in Mines.—1889.
- SHAW, THOMAS.
Gunpowder Pile Driver.—1872.
- SHAW, THOMAS.
Spiral Exhaust Nozzle.—1877.
- SHAW, THOMAS.
Friction Buffer.—1883.
- SHAY, EPHRAIM.
Geared Locomotive.—1892.
- SHEDLOCK, ALFRED, AND HANNAY, J. B.
Lamp for Engineering Uses.—1891.
- SHIMER, P. W.
Combustion Crucible.—1901.
- SHOLES, C. LATHAM; GLIDDENS, CARLOS; SOULE, SAMUEL W.
Typewriter.—1875.

- SHORE, A. F.
Scleroscope.—1909.
- SHUMAN, F. S.
Wired Glass.—1894.
- SHUMAN, F.
Concrete Pile for Foundations.—1904.
- SMITH, R. C.; OTIS, SIDNEY; IHLDER, J. D.; SUNDH, AUGUST.
Electric Elevator.—1902.
- SOULE, SAMUEL W.; GLIDDENS, CARLOS; SHOLES, C. LATHAM.
Typewriter.—1875.
- SPEIDEL, J. G.
Hoisting Machines.—1891.
- SPELLIER, L. H.
Electric Clock.—1887.
- SPENCER, J. E., AND FIELD, D. W.
Damper Regulator.—1893.
- SPERRY, E. A.
Gyroscope Compass.—1914.
- SPIELMAN, A.
Cloth Cutting Machine.—1914.
- SPIRO, C.
Barlock Typewriter.—1894.
- SPRATT, ORLANDS W.
Mercury Seal Trap.—1885.
- SPRINGER, ALFRED, AND ROEDER, F. A.
Torsion Balance.—1891.
- SQUIER, G. O., AND CREHORE, A.
Polarizing Photo-Chronograph.—1896.
- STACKHOUSE, THOMAS H.
Diagraph.—1895.
- STAHLBERG, C.
Time Dating Stamp.—1891.
- STARR, J. E.; BRANSON, DAVID; THORNBURGH, R. D.; FULLER, J. E.
Refrigeration Process.—1894.
- STEINBART, ALFRED, AND UEHLING, EDWARD.
Pneumatic Pyrometer.—1898.
- STEINBART, ALFRED, AND UEHLING, EDWARD.
Gas Composimeter.—1899.
- STELLWAGON, H. S.
Sounding Apparatus.—1848.
- STIERINGER, L.
Improved Method of Electric Illumination.—1902.
- STREET, CLEMENT F.
Locomotive Stoker.—1915.
- STRICKLAND, W.
Substitution of Lime for Salt for Preserving Lumber.—1840.

- SUNDH, AUGUST; OTIS, SIDNEY; SMITH, A. C.; IHLDER, J. D.
Electric Elevator.—1902.
- SWEETLAND, ERNEST J.
Filter Press.—1918.
- SWENSON, MAGNUS.
Round Lap Baling Cotton Compress.—1900.
- TABER, HARRIS; LEWIS, WILFRED; MUMFORD, E.
Molding Machines.—1902.
- TAINTER, SUMMER, AND BELL, CHICHESTER, A.
Apparatus for Recording Sound.—1900.
- TALBOT, E.
Improved Methods in the Manufacture of Steel.—1908.
- TATHAM, B., AND BRITTIN, J. W.
Safety Catch for Elevators.—1875.
- TATTERSALL, ALFRED R.
Flour Mill.—1917.
- TAYLOR, C. M., JR.
Absorption Process for Butter Making.—1903.
- TEAL, C. A.
Portable Hoist.—1889.
- THOMAS, ALMER, AND MERKET, LUZERNE.
Tempered Copper.—1891.
- THOMSON, ELIHU.
Electric Welding.—1889.
- THOMSON, ELIHU.
Constant Current Arc Light Transformer.—1901.
- THORNBURGH, R. D.; STARR, J. E.; BRANSON, DAVID; FULLER, J. E.
Refrigeration Process.—1894.
- THUM, CHARLES D.
Varnish Brushes.—1854.
- TIRRILL, A. A.
Voltage Regulator.—1910.
- TIRRELL, J. P.; REYNOLDS, J. R.; PALMER, F. S.
Engine Stop and Speed Limit System.—1906.
- TOWNSEND, ISAAC.
Tent Fastening.—1885.
- TWEDDELL, R. H.
Method of Applying Hydraulic Power to Mechanical Work.—1894.
- TYLER, PHILOS B.
Shifting Gauge Cock for Steam Boilers.—1835.
- TYSON, CHARLES.
Machine to Unite Uppers to the Soles of Shoes.—1875.
- UEHLING, EDWARD, AND STEINBART, ALFRED.
Gas Composimeter.—1899.
- UEHLING, EDWARD, AND STEINBART, ALFRED.
Pneumatic Pyrometer.—1898.

- VAN KANNEL, T.
Storm Door.—1890.
- VAUCLAIN, SAMUEL M.
Truck Wheel Centres.—1891.
- VILLEROI, M.
Telescope.—1849.
- VOYNOW, C. B., AND NICHOLS, H. B.
Cast Zinc Joint for Rail Bonding.—1904.
- WAHL, J. C., AND GOLDBERG, H. E.
Adding Machine.—1916.
- WAIT, W. B.
Machine for Tangible Writing for Touch Reading.—1900.
- WALE, GEORGE AND COMPANY.
Projection Lantern.—1875.
- WALSH, E. M. AND SYDNEY B.
Method of Making Large Objects from Pieces of Aventurine.—1902.
- WALSH, SYDNEY B. AND E. M.
Method of Making Large Objects from Pieces of Aventurine.—1902.
- WALTER, L. H.
Method of Detecting Electrical Oscillations.—1907.
- WALTER, E.
Electric Switch.—1905.
- WEBSTER, W. R.
Apparatus for Observing the Relations between the Chemical Constitution and Ultimate Strength of Steel.—1897.
- WEHNELT, A.
Interrupter for Induction Machines.—1905.
- WELIN, A.
Life Saving Appliances on Board Ship.—1910.
- WESTINGHOUSE, GEORGE, JR.
Railway Car Brake.—1874.
- WETZEL, F. J.
Automatic Mechanical Stoker.—1909.
- WHARTON, WILLIAM, JR.
Safety Railway Switch.—1873.
- WHEELER, S. S.
Electric Fan.—1904.
- WHITALL, HENRY.
Planisphere.—1883.
- WHITE, O. C.
Adjustable Extension Movement in Ball and Socket Joints.—1889.
- WIEDIG, H. P.
Chemical Fire Extinguisher.—1894.
- WIGMORE, WILLIAM H., AND DOERR, JOHN H.
Sleeping Car.—1885.
- WILKIN, J. T.
System of Generating and Forming Cycloidal Surfaces.—1894.

- WHITOX, CHARLES H., AND CARLETON, CYRUS.
Automatic Tension and Improved Sewing Machines.—1875.
- WILLIAMS, P. W.
Steam Engine.—1895.
- WILLIAMS, C. D.
Revolving Show Window.—1892.
- WILLIAMS, JOHN N.
Typewriting Machine.—1897.
- WILLMUNDER, H.
Swivel Loom.—1898.
- WILLS, SAMUEL.
Journal Bearing and Car Axle-Box.—1885.
- WINSLOW, S. E.
Pivot Scale Beam.—1840.
- WIRT, CHARLES.
Rheostat.—1902.
- WOOD, R. W.
Diffraction Color Photography.—1907.
- WOOD, THOMAS.
Fountain Pen.—1839.
- WOODBURY, C. J. H.
Electric Light Main Testing Apparatus.—1884.
- WOODRUFF, W. N.
System of Keying for Machinery.—1888.
- WOOTEN, J. E.
Locomotive and Boiler.—1890.
- WURTZ, A. J.
Lightning Arrestors and Non-Arcing Metal.—1894.
- YARYAN, H. T.
System of Evaporation in Vacuo.—1886.
- YEOMANS, LUCIEN I.
Method of Machine Construction.—1917.
- ZIEGLER, G. W.
Trestles and Scaffolding.—1888.

TERMS AND PRIVILEGES OF MEMBERSHIP

The members of the Institute are divided into the following classes, viz.: *Resident Members, Stockholders, Life Members, Permanent Members, Non-resident and Associate Members.*

Any one interested in the purposes and objects of the Institute and expressing a willingness to further the same may become a member when proposed by a member in good standing and elected by the Board of Managers.

Terms.—Resident members pay Fifteen Dollars each year. The payment of Two Hundred Dollars in any one year secures Life Membership, with exemption from annual dues.

Stock.—Second-class stockholders pay an annual tax of Twelve Dollars per share, and the holder of one share is entitled by such payment to the privileges of membership.

Privileges.—Each contributing member (including non-residents) and adult holder of second-class stock is entitled to participate in the meetings of the Institute, to use the Library and Reading Room, to vote at the Annual Election for officers, to receive tickets to the lectures for himself and friend, to attend the Section meetings and to receive one copy of the JOURNAL free of charge, except associate members, who may not take part in elections.

Permanent Members.—The Board of Managers may grant to any one who shall in any one year contribute to the Institute the sum of One Thousand Dollars a permanent membership, transferable by will or otherwise.

Non-resident Members.—Newly elected members residing permanently at a distance of twenty-five miles or more from Philadelphia may be enrolled as Non-resident Members, and are required to pay an entrance fee of Five Dollars, and Five Dollars annually. Non-resident Life Membership, \$75.00.

Contributing members, if eligible, under the non-resident clause, on making request therefor, may be transferred to the non-resident class by vote of the Board of Managers, and are required to pay Five Dollars annually.

Associate Members.—Associate members are accorded all the privileges of the Institute, except the right to vote or hold office, upon the payment of annual dues of Five Dollars. This class of membership is limited to persons between the ages of seventeen and twenty-five years. Upon reaching the age limit they become eligible to the other classes of membership.

Resignations must be made in writing, and dues must be paid to the date of resignation.

MEMBERSHIP DIRECTORY

HONORARY MEMBERS

- Brigadier General **JAMES ALLEN**, U.S.A. (Retired), Army and Navy Club, Washington, D. C.
Colonel **GEORGE L. ANDERSON**, U.S.A. (Retired),
Prof. **SVANTE AUGUST ARRHENIUS**, Nobel Institute, Stockholm, Sweden.
Brigadier General **JOHN J. CARTY**, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
Prof. **CHARLES F. CHANDLER**, Columbia University, New York City, New York.
Sir **JAMES DEWAR**, The Royal Institution, London, W. 1., England.
Mr. **THOMAS A. EDISON**, Orange, New Jersey.
Prof. **CHARLES FABRY**, Professor of Physics, University of Paris, 1 Rue Victor-Cousin, Paris (5e), France.
Prof. **GEORGE FORBES**, No. 11 Little College Street, Westminster, S. W., London, England.
Prof. **HENDRIK A. LORENTZ**, Zylweg 76, Haarlem, Holland.
Senator **GUGLIELMO MARCONI**, Royal Italian Senate, Rome, Italy.
Dr. **T. C. MENDENHALL**, Ravenna, Ohio.
Dr. **RALPH MODJESKI**, 818 Widener Building, Philadelphia, Pennsylvania.
Rear Admiral **JOSEPH B. MURDOCK**, U.S.N. (Retired), Danbury, New Hampshire.
Prof. **HEIKE KAMERLINGH ONNES**, University of Leiden, Leiden, Holland.
Hon. Sir **CHARLES A. PARSONS**, 6 Windsor Terrace, Newcastle-On-Tyne, England.
General **JOHN J. PERSHING**, War Department, Washington, D. C.
Mr. **RALPH W. POPE**, 570 Cherry Street, Elizabeth, New Jersey.
Prof. **THEODORE WILLIAM RICHARDS**, Wolcott Gibbs Memorial Laboratory, Harvard University, Cambridge, Massachusetts.
Rear Admiral **WILLIAM S. SIMS**, U.S.N., General Board, Naval War College, Newport, Rhode Island.
Mr. **FRANK J. SPRAGUE**, Consulting Engineer, President, Sprague Safety Control & Signal Corporation, 421 Canal Street, New York City, New York.
Major-General **GEORGE OWEN SQUIER**, War Department, Washington, D. C.
Rear Admiral **DAVID WATSON TAYLOR**, Bureau of Construction and Repair, Navy Department, Washington, D. C.
Sir **JOSEPH J. THOMSON**, Trinity College, Cambridge, England.
Prof. **WILLIAM CAWTHORNE UNWIN**, Palace Gate Mansions, Kensington, London, England.
Dr. **H. W. WILEY**, Room 1120, Woodward Building, Washington, D. C.

CORRESPONDING MEMBERS

- Professor **A. S. EVE**, McGill University, Montreal, Canada.
Mr. **T. COMMERFORD MARTIN**, 29 West 39th Street, New York City, New York.
Prof. **JOHN SEALY TOWNSEND**, New College, Oxford, England.

IN MEMORIAM

- Mr. **ISAAC B. THORN**.

MEMBERS

- ABBOTT, ROBERT R.**, Metallurgical Engineer, The Peerless Motor Car Company, Cleveland, Ohio.
ACHESON, Dr. EDWARD G., Manufacturer, Acheson Corporation, Æolian Building, 35 West 42nd Street, New York City, New York.
ADAMS, HOWARD L., Managing Director, Keystone Institute, Reading, Pennsylvania.
ADAMS, MERRITT H., Works Manager, Vim Motor Company, 23rd & Market Streets, Philadelphia, Pennsylvania.
ADDICKS, WALTER R., Vice President, Consolidated Gas Company of New York, 130 E. 15th Street, New York City, New York.

- ADSIT, CHARLES G., Engineer, 555 Electric and Gas Building, Atlanta, Georgia.
- AKELEY, CARL E., Taxidermist and Sculptor, American Museum of Natural History, 77th Street and Central Park West, New York City, New York.
- AKIMOFF, NICHOLAS W., Mechanical and Hydraulic Engineer, 1013 Harrison Building, Philadelphia, Pennsylvania.
- ALBRECHT, A. C., Vice President, North Brothers Manufacturing Company, Lehigh Avenue and American Street, Philadelphia, Pennsylvania.
- ALLAN, ANDREW, JR., Manufacturer of Bearing Metals, Harrison, New Jersey.
- ALLEMAN, GELLERT, Professor of Chemistry, Swarthmore College, and for mail, 8 Whittier Place, Swarthmore, Pennsylvania.
- ALLEN, HENRY B., Metallurgical Engineer, 8112 St. Martins Lane, Chestnut Hill, Philadelphia, Pennsylvania.
- ALLEN, JAMES, Brigadier General, U.S.A., Army and Navy Club, Washington, D. C.
- ALLEN, WILLIAM E., Clerk, 109 S. 43rd Street, Philadelphia, Pennsylvania.
- ALLEN, WILLIAM N., Retired Chemical Manufacturer, 557 Church Lane, Germantown, Philadelphia, Pennsylvania.
- ALSBERG, Dr. CARL L., Stanford University, California.
- AMES, Dr. JOSEPH S., Director Physical Laboratory, The Johns Hopkins University, Baltimore, Maryland.
- ANDERSON, OLAF, Geologist, Norges Geologiske Undersokilse, Kronprinsensgt 2, Kristiania, Norway.
- ANDERSON FRANK, Mining Engineer, 468 12th-East Street, Salt Lake City, Utah.
- ANDERSON, Colonel GEORGE L., U.S.A., Electrical Engineer, Address unknown.
- ANDERSON, ROBERT J., Metallurgical Engineer, U.S. Bureau of Mines, Experiment Station, Pittsburgh, Pennsylvania.
- ANDREAU, ROLAND L., Consulting Chemical Engineer and Research Chemist, Laurel Springs, New Jersey.
- ANDREWS, W. S., Consulting Electrical Engineer, General Electric Company, Schenectady, New York.
- ANGERER, VICTOR, Vice-President, Taylor-Wharton Iron and Steel Company, P. O. Box 162, Ridley Park, Pennsylvania.
- ARMSTRONG, WILLIAM R., Clerk, Powers-Weightman-Rosengarten Company, Philadelphia, Pennsylvania.
- ARNY, Dr. H. V., Teacher and Chemist, 115 West 68th Street, New York City, New York.
- ARRHENIUS, SVANTE AUGUST, Physicist, Nobel Institute, Stockholm, Sweden.
- ASEF, Dr. WALDEMAR, Research Chemist, Research Department, Pennsylvania Salt Manufacturing Company, Greenwich Point, Philadelphia, Pennsylvania.
- ASHBROOK, Dr. DONALD S., Chemist, 2404 Willard Street, Wilmington, Delaware.
- ASHHURST, JOHN, Librarian, The Free Library of Philadelphia, 13th and Locust Streets, Philadelphia, Pennsylvania.
- ASHMEAD, FRANK M., Civil Engineer, The Locust, Pennsylvania Avenue, Atlantic City, New Jersey.
- ATLEE, JOSHUA W., Naval Architect, William Cramp and Son's Ship and Engine Building Company, and for mail, Riverton, New Jersey.
- ATLEE, WALTER, Civil Engineer, North Avenue, Mt. Washington, Maryland.
- ATTERBURY, W. W., Brigadier-General, Vice-President, Pennsylvania Railroad Company, Broad Street Station, Philadelphia, Pennsylvania.
- ATWATER, RICHARD M. Jr., Consulting Mining Engineer, Scarsdale, New York.
- AUSTIN, Dr. LOUIS W., U. S. Naval Radio Research Laboratory, Bureau of Standards, Washington, D. C.
- AUSTIN, W. L., Vice Chairman of the Board, The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- AYRES, EUGENE E., JR., Chemical Engineer, Sharples Specialty Company, 23rd and Westmoreland Streets, Philadelphia, Pennsylvania.
- BACHE, DANIEL T., Student, 2102 Pine Street, Philadelphia, Pennsylvania.
- BACON, Dr. RAYMOND FOSS, Chemical Engineer, Chemists Building, 50 East 41st Street, New York City, New York.
- BAEKELAND, Dr. L. H., Research Chemist, Snug Rock, Harmony Park, Yonkers-on-Hudson, New York.
- BAKER, FRANKLIN, JR., Manufacturer, Wayne Avenue and Hortter Street, Germantown, Philadelphia, Pennsylvania.
- BAKER, GEORGE FALES, Physician, 403 Lafayette Building, Philadelphia, Pennsylvania.
- BALCH, ALFRED C., Publisher, 227 South 6th Street, Philadelphia, Pennsylvania.
- BALCH, EDWIN S., Attorney-at-Law, 1634 Spruce Street, Philadelphia, Pennsylvania.
- BALDWIN, FREDERIC E., (Retired), 2200 Walnut Street, Philadelphia, Pennsylvania.

- BALLARD, JUDSON T.**, Chemist, 1010 Chelton Avenue, Oak Lane, Philadelphia, Pennsylvania.
- BALLARD, R. H.**, Vice President and Assistant General Manager, Southern California Edison Company, Edison Building, Los Angeles, California.
- BALLENTINE, WILLIAM L.**, Vice President, Advance Rumely Company, La Porte, Indiana.
- BALLINGER, WALTER F.**, Architect, Twelfth and Chestnut Streets, Philadelphia, Pennsylvania.
- BANCROFT, JOHN**, Manufacturer, Wilmington, Delaware.
- BANCROFT, JOSEPH**, Vice President and Treasurer, Joseph Bancroft and Sons, Wilmington, Delaware.
- BANNISTER, J. C.**, Lock Box 26, Boston, Massachusetts.
- BARNES, JAMES**, Professor of Physics, Bryn Mawr College, Bryn Mawr, Pennsylvania.
- BARNES, JOHN HAMPTON**, Attorney-at-Law, Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- BARNETT, EDWIN S.**, Wheat Starch Manufacturer, 7011 Cresheim Road, Mt. Airy, Philadelphia, Pennsylvania.
- BARNHART, G. EDWARD**, Aeronautical Engineer, 191 Marion Avenue, Pasadena, California.
- BARR, Major JOHN H.**, Mechanical Engineer, Remington Typewriter Company, 374 Broadway, New York City, New York.
- BARRINGER, DANIEL MOREAU**, Geologist and Mining Engineer, 1242 Real Estate Trust Building, Philadelphia, Pennsylvania.
- BARTH, CARL G.**, Consulting Engineer, Room 216, 10 South 18th Street, Philadelphia, Pennsylvania.
- BARTLESON, T. LEES**, Chemist, E. I. du Pont de Nemours and Company, and for mail, 305 W. 19th Street, Wilmington, Delaware.
- BARTOW, EDWARD**, Chemistry Department, State University of Iowa, Iowa City, Iowa.
- BARWIS, CALVIN W.**, Civil Engineer, In care of Interior Oil and Gas Corporation, 302 East Street, Warren, Pennsylvania.
- BASFORD, G. M.**, President, Locomotive Feed Water Heater Company, Room 719, 17 East 42nd Street, New York City, New York.
- BASHORE, E. GORGAS**, Consulting Chemical Engineer, in care of Dr. J. D. Bashore, Shippensburg, Pennsylvania.
- BASSETT, WILLIAM H.**, Technical Superintendent, American Brass Company, Waterbury, Connecticut, and for mail, Cheshire, Connecticut.
- BATES, C. W.**, Electrical Engineer, Philadelphia Electric Company, and for mail, 403 N. Narberth Avenue, Narberth, Pennsylvania.
- BATES, ONWARD**, Civil Engineer, 332 South Michigan Avenue, Chicago, Illinois.
- BEACH, CHARLES S.**, Designer and Machinist, 745 Main Street, Bennington, Vermont.
- BEALE, HORACE A., JR.**, President, Parkesburg Iron Company, Parkesburg, Pennsylvania.
- BEALE, LEONARD T.**, Secretary, John T. Lewis & Brother Company, 705 Lafayette Building, Philadelphia, Pennsylvania.
- BEATH, E. R.**, Lapidist and Jeweler, 129 South 12th Street, Philadelphia, Pennsylvania.
- BECK, M. A.**, Vice President and Chief Engineer, Milwaukee Electric Crane and Manufacturing Company, 294 Greenbush Street, Milwaukee, Wisconsin.
- BECKER, IRWIN A.**, Pharmacist, in care of Michael Reese Hospital, 2839 Ellis Avenue, Chicago, Illinois.
- BELFIELD, T. BROOM**, Manufacturer, 1905 Spring Garden Street, Philadelphia, Pennsylvania.
- BELL, J. SNOWDEN**, Attorney-at-Law, P. O. Box 629, City Hall Station, New York City, New York.
- BEMENT, CLARENCE S.**, 3907 Spruce Street, Philadelphia, Pa.
- BEMENT, WILLIAM P.**, (Retired), 743 Real Estate Trust Building, Philadelphia, Pennsylvania.
- BENNETT, FREDERICK M.**, Mechanical and Electrical Engineer, 2516 Harlan Street, Philadelphia, Pennsylvania.
- BENZON, GEORGE H., JR.**, Mechanical Engineer, 252 Mather Road, Jenkintown, Pennsylvania.
- BERG, ERNST J.**, Professor of Electrical Engineering, Union College, Schenectady, New York.
- BERG, HOLGER V.**, Chemical Engineer, Newport, Delaware.
- BERLINER, EMILE**, Engineer, 1458 Columbia Road, Washington, D. C.
- BERLINER, HERBERT S.**, Engineer, in care of Berliner Gramophone Company, Montreal, Canada.
- BERRESFORD, A. W.**, General Manager, The Cutler-Hammer Manufacturing Company, Milwaukee, Wisconsin.

- BEST, W. N.**, President, W. N. Best, Incorporated, Engineers in Caloric, 11 Broadway, New York City, New York.
- BIDDLE, CHARLES M., JR.**, First Vice President, Supplee-Biddle Hardware Company, 517 Commerce Street, Philadelphia, Pennsylvania.
- BIDDLE, ELIZABETH C.**, 400 South 15th Street, Philadelphia, Pennsylvania.
- BIDDLE, H. W.**, Stock Broker, 424 Chestnut Street, Philadelphia, Pennsylvania.
- BIDDLE, JAMES G.**, Importer of Scientific Apparatus, Wallingford, Pennsylvania.
- BIDDLE, ROBERT**, President, Biddle-Gaumer Company, 3846-56 Lancaster Avenue, Philadelphia, Pennsylvania.
- BIERBAUM, CHRISTOPHER H.**, Consulting Engineer, 1011 Mutual Life Building, Buffalo, New York.
- BIGELOW, S. LAWRENCE**, Professor of General and Physical Chemistry, University of Michigan, Ann Arbor, Michigan.
- BILGRAM, HUGO**, Machinist, 1235 Spring Garden Street, Philadelphia, Pennsylvania.
- BILLINGS, A. W. K.**, Civil, Mechanical and Electrical Engineer, Canadian and General Finance Company, Limited, Dominion Bank Building, Toronto, Canada.
- BILLOW, CLAYTON O.**, Consulting Engineer, 6800 Sheridan Road, Chicago, Illinois.
- BILYEU, THOMAS**, Mechanical Engineer, 697 E. Broadway Street, Portland, Oregon.
- BINDER, RICHARD L.**, President, K. & B. Company, Special Electrical Supplies, 931 North 8th Street, Philadelphia, Pennsylvania.
- BINNS, ARTHUR W.**, Steam Engineer, Morton, Pennsylvania.
- BIRCH, GEORGE W., JR.**, Chemist, 1414 East Columbia Avenue, Philadelphia, Pennsylvania.
- BIRKINBINE, CARL PETER**, Engineer, Room 800, Commercial Trust Building, Philadelphia, Pennsylvania.
- BLACKBURN, ARTHUR**, Grain Merchant, 315 Chamber of Commerce, and for mail, 5905 York Road, Baltimore Maryland.
- BLACKBURN, CAROLINE D.**, Chemist, 510 Midvale Avenue, Germantown, Philadelphia, Pennsylvania.
- BLAIR, A. A.**, Analytical Chemist, 406 Locust Street, Philadelphia, Pennsylvania.
- BLAKELEY, ABRAHAM G.**, Chief Chemist, Philadelphia and Reading Coal and Iron Company, Pottsville, Pennsylvania.
- BLATZ, FREDERICK J.**, Leather Manufacturer, P. O. Box 967, Wilmington, Delaware.
- BLUM, ARTHUR N.**, Mechanical Engineer, Delmar-Morris Apartments, Germantown, Philadelphia, Pennsylvania.
- BODINE, SAMUEL T.**, President, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- BOEHMKE, Dr. RODRICH**, Manufacturing Optician, 827 Spring Garden Street, Philadelphia, Pennsylvania.
- BOEKEL, J.**, Manufacturer of Metal Goods, 518 Vine Street, Philadelphia, Pennsylvania.
- BOERICKE, FELIX A.** (Retired), Bryn Athyn, Pennsylvania.
- BOERICKE, GIDEON**, Civil Engineer, Wynnewood, Pennsylvania.
- BOERICKE, JOHN J.**, Metallurgist, Secretary, Primos Chemical Company, and for mail, Merion, Pennsylvania.
- BONINE, CHARLES E.**, Consulting and Designing Engineer, Franklin Trust Building, 20 South 15th Street, Philadelphia, Pennsylvania.
- BOOZ, H. C.**, Chief Engineer, Berwind-White Coal Mining Company, 1100 Commercial Trust Building, Philadelphia, Pennsylvania.
- BORGNER, CYRUS**, Manufacturer of Fire Brick and Clay Retorts, 234 North 23rd Street, Philadelphia, Pennsylvania.
- BORIE, BEAUVEAU, JR.**, Investment Broker, 511 Chestnut Street, Philadelphia, Pennsylvania.
- BORTON, GEORGE W.**, President and General Manager, Pennsylvania Crusher Company, 1324 Stephen Girard Building, Philadelphia, Pennsylvania.
- BOSTWICK, J. VAUGHAN**, St. Davids, Pennsylvania.
- BOURNE, GEORGE L.**, Vice President, Locomotive Superheater Company, 30 Church Street, New York City, New York.
- BOWEN, SAMUEL B.**, Manufacturer, 4th Street and Sedgley Avenue, Philadelphia, Pennsylvania.
- BOWER, C. P.**, Civil Engineer, 403 Westview Avenue, Philadelphia, Pennsylvania.
- BOWER, WILLIAM HENRY**, Manufacturing Chemist, 29th Street and Grays Ferry Road, Philadelphia, Pennsylvania.
- BOYER, MURRAY C.**, Solicitor of Patents, 806 Franklin Trust Building, Philadelphia, Pennsylvania.
- BRADBURY, Dr. ROBERT H.**, Science Teacher, Southern High School, 2100 Shunk Street, Philadelphia, Pennsylvania.
- BRADDOCK-ROGERS, K.**, Trinity College, Hartford, Connecticut.

- BRADLEY, A. J.**, Manufacturer, 101 Beekman Street, New York City, New York.
- BRADSHAW, WILLIAM HENRY**, Chemist, 1241 Carpenter Street, Philadelphia, Pennsylvania.
- BRADY, EDWARD J.**, Engineering Research, 3101 Passyunk Avenue, Philadelphia, Pennsylvania.
- BREED, GEORGE**, Consulting Engineer, 277 Harvey Street, Germantown, Philadelphia, Pennsylvania.
- BREWER, Dr. J. EDWARD**, Chemist, 215 Summit Street, Norristown, Pennsylvania.
- BREWSTER, FRANK H.**, General Superintendent, United States Rubber Reclaiming Works, 180 Woodbridge Avenue, Buffalo, New York.
- BRIESEN, FRITZ V.**, Attorney-at-Law, 25 Broad Street, New York City, New York.
- BRIGHT, J. I.**, Architect, Villa Nova, Pennsylvania.
- BRIMMER, F. E.**, Chemical Manufacturer, Hydrocarbon Chemical Company, Lancaster, Pennsylvania.
- BRINLEY, CHARLES E.**, President, American Pulley Company, 4200 Wissahickon Avenue, Philadelphia, Pennsylvania.
- BRINTON, RUSSELL L.**, Carol Boulevard, Highland Park, Delaware County, Pennsylvania.
- BRINTON, WILLIAM C., JR.**, Chief Engineer, Philbrin Corporation, Kennett Square, Pennsylvania.
- BROCK, JOHN W.** Retired Attorney, 511 Bullitt Building, Philadelphia, Pennsylvania.
- BROMLEY, JOSEPH H.**, Manufacturer, Chelton and Wissahickon Avenues, Philadelphia, Pennsylvania.
- BROWN, FRANCIS SHUNK**, Lawyer, 1005 Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- BROWN, J. STANFORD**, P. O. Box 38, Black Hall, Connecticut.
- BROWN, KENNETH R.**, Chemist, Atlas Club, Tamaqua, Pennsylvania.
- BROWN, LUCIUS P.**, Chemist, Franklin, Tennessee.
- BROWN, RICHARD P.**, President, Brown Instrument Company, Wayne and Windrim Avenues, Philadelphia, Pennsylvania.
- BROWNSTEIN, BENJAMIN**, Mechanical Engineer, Elwood City, Pennsylvania.
- BRUNEL, ROGER F.**, Professor of Chemistry, Bryn Mawr College, Bryn Mawr, Pennsylvania.
- BRUNNER, FRANK A.**, Drawing Materials, 910 Filbert Street, Philadelphia, Pennsylvania.
- BRUNKER, ROBERT J.**, Banker, 1000 Walnut Street, Philadelphia, Pennsylvania.
- BRUSH, CHARLES F.**, Electrical Engineer, 3725 Euclid Avenue, Cleveland, Ohio.
- BUCHANAN, CHARLES GORDON**, Mechanical Engineer, 167 North Munn Avenue, East Orange, New Jersey.
- BUCK, H. W.**, Consulting Engineer, 49 Wall Street, New York City, New York.
- BUDD, A. VAN WYCK**, Berwyn, Prince George County, Maryland.
- BUDD, EDWARD G.**, Machinist, 502 Westview Street, Germantown, Philadelphia, Pennsylvania.
- BULLITT, JOHN C., 3rd**, 1811 Walnut Street, Philadelphia, Pennsylvania.
- BULLOCK, WILLIAM E.**, Mechanical Engineer, 29 West 39th Street, New York City, New York.
- BUMCKE, Dr. GEBHARDT**, Chemist, Trades Oil Products Company, 172-180 Prelinghuysen Avenue, Newark, New Jersey.
- BUNNELL, STERLING H.**, Consulting Mechanical Engineer, 103 Park Avenue, New York City, New York.
- BUREAU, E. W.**, Bronze Founder, S. E. Corner 23rd and Westmoreland Streets, Philadelphia, Pennsylvania.
- BURGESS, WILLIAM J.**, Pennsylvania Coal Products Company, Petrolia, Pennsylvania.
- BURHORN, EDWIN**, Engineer and Contractor, 938 Hudson Street, Hoboken, New Jersey.
- BURLINGAME, LUTHER D.**, Industrial Superintendent, Brown and Sharp Manufacturing Company, Providence, Rhode Island.
- BURNHAM, GEORGE, JR.**, (Retired), 1301 Morris Building, Philadelphia, Pennsylvania.
- BURROUGHS, JOSEPH H.**, Attorney-at-Law, 664 Bullitt Building, Philadelphia, Pennsylvania.
- BURT, MILO C.**, Chemist, 636 Water Street, Bridgeport, Connecticut.
- BURTON, THOMAS L.**, Consulting Engineer, Westinghouse Air Brake Company, 165 Broadway, New York City, New York.
- BUSH, S. P.**, Manufacturer, The Buckeye Steel Castings Company, Columbus, Ohio.
- BUSSER, FRANK S.**, Attorney-at-Law, 926 Land Title Building, Philadelphia, Pennsylvania.
- BUTLER, CHARLES N.**, Attorney-at-Law and Solicitor of Patents, 1318 Land Title Building, Philadelphia, Pennsylvania.

- BUXTON, GEORGE E., Industrial Engineer, 322 King Street, Pottstown, Pennsylvania.
- BYERS, ISAAC W., (Retired), Iron River, Michigan.
- BYRD, JOHN, Metal Worker. Address unknown.
- BYRNES, FRANK, Clerk, 535 West Montgomery Avenue, Philadelphia, Pennsylvania.
- CABOT, GEORGE E., 60 State Street, Boston, Massachusetts.
- CADWALDER, Major GOUVERNEUR, Manufacturer, O.O.R.C., Fort Washington, Pennsylvania.
- CAIRD, JAMES M., Chemist and Bacteriologist, Proctor's Building, 92 Fourth Street, Troy, New York.
- CALKINS, G. H., Manager, General Electric Company, Tenth Floor, Electric Building, Buffalo, New York.
- CALVERT, HAROLD, Electrical Engineer, President, Baird-Osterhout Company, 2114 Sansom Street, Philadelphia, Pennsylvania.
- CAMERON, Dr. FRANK K., Consulting Chemist, 46 Bransford Apartments, Salt Lake City, Utah.
- CANBY, WILLIAM W., Fruit Grower, Grants Pass, Oregon.
- CANFIELD, FREDERICK, A., Mining Engineer, Dover, New Jersey.
- CAPLES, MARTIN J., Vice President, Seaboard Airline Railway Company, and for mail, 701 Stockley Gardens, Norfolk, Virginia.
- CAPP, JOHN A., Mechanical Engineer, 62 Bedford Road, Schenectady, New York.
- CAPP, S. BUNKER, Capitalist, P. O. Box 2054, Philadelphia, Pennsylvania.
- CAPPS, W. L., Rear Admiral, U.S.N., Chief Constructor, Bureau of Construction and Repair, Navy Department, Washington, D. C.
- CARTER, EDWARD C., Consulting Engineer, 412 Greenwood Boulevard, Evanston, Illinois.
- CARTER, JOHN E., (Retired), 5356 Knox Street, Germantown, Philadelphia, Pennsylvania.
- CARTY, Brig. General, JOHN J., Vice-President and Chief Engineer, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
- CASPARI, Dr. CHARLES E., Professor of Chemistry, 2108 Locust Street, St. Louis, Missouri.
- CASSELMAN, WILLIAM S., Attorney-at-Law, Secretary, West Jersey Title and Guarantee Company, and for mail, 317 Penn Street, Camden, New Jersey.
- CATHERWOOD, WILSON, Merchant, 1708 Walnut Street, Philadelphia, Pennsylvania.
- CHAFFEE, E. LEON, Assistant Professor of Physics, Cruft Laboratory, Cambridge, Massachusetts.
- CHAMBERLAIN, G. E., Engineer, 1650 East William Street, Decatur, Illinois.
- CHAMBERS, Dr. ARTHUR DOUGLAS, Chemical Engineer, E. I. du Pont de Nemours and Company, and for mail, R. F. D. 1, Edgemoor, Delaware.
- CHAMBERS, FRANCIS T., Attorney-at-Law, 605-608 New Stock Exchange Building, 1411 Walnut Street, Philadelphia, Pennsylvania.
- CHAMBERS, J. HOWARD, Chambers Brothers Company, Founders and Machinists, and for mail, 52nd and Media Streets, Philadelphia, Pennsylvania.
- CHANCE, Dr. EDWIN M., Consulting Chemist and Engineer, 107 S. Surrey Place, Ventnor, New Jersey.
- CHANCE, Dr. HENRY M., Mining Engineer and Geologist, 839 Drexel Building, Philadelphia, Pennsylvania.
- CHANDLER, CHARLES F., Emeritus Professor of Chemistry, Columbia University, New York City, New York.
- CHANDLER, T. P., Architect, 249 South 16th Street, Philadelphia, Pennsylvania.
- CHARLTON, RICHARD C., 5017 Franklin Street, Frankford, Philadelphia, Pennsylvania.
- CHESTERMAN, FRANCIS J., Chief Engineer, The Bell Telephone Company, 261 North Broad Street, Philadelphia, Pennsylvania.
- CHRISTIANSON, A., Chief Engineer, Standard Steel Car Company, and for mail, 198 West Pearl Street, Butler, Pennsylvania.
- CHURCH, ARTHUR L., Assistant to the President, The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- CLAGHORN, CLARENCE R., Mining Engineer, 715 Continental Building, Baltimore, Maryland.
- CLAMER, F. J., (Retired), Collegeville, Montgomery County, Pennsylvania.
- CLAMER, G. H., Metallurgist and Chemist, First Vice President and Secretary, The Ajax Metal Company, Frankford Avenue and Richmond Street, Philadelphia, Pennsylvania.
- CLARK, A. WAYNE, Chemist, in care of Johnson and Johnson, New Brunswick, New Jersey.
- CLARK, BEAUVAIS, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, MISS DARTHELA, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, EDWARD B., Publisher, 61 Cedar Street, Chicago, Illinois.

- CLARK, EDWARD L.**, Chief Engineer, Commercial Truck Company, Hunting Park and Rising Sun Avenues, Philadelphia, Pennsylvania.
- CLARK, E. W.**, Banker, 321 Chestnut Street, Philadelphia, Pennsylvania.
- CLARK, FRANK H.**, Consulting Engineer and Technical Advisor, Tuscany Apartments, 40th and Stony Run Roads, Baltimore, Maryland.
- CLARK, FRANK SHAW**, Mechanical Engineer, Stone and Webster Engineering Corporation, 147 Milk Street, Boston, Massachusetts.
- CLARK, JOSEPH S.**, Attorney-at-Law, Highland Avenue, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, THEOBALD F.**, 2300 Pine Street, Philadelphia, Pennsylvania.
- CLARK, WALTON**, Engineer, Vice President, The United Gas Improvement Company, and for mail, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, MRS. WALTON**, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, WALTON, JR.**, Attorney-at-Law, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLOUD, JOHN W.**, Chairman, The Westinghouse Brake and Saxby Signal Company, Limited, 82 York Road, King's Cross, London, N. I. England.
- CLYMER, EVAN MORGAN**, Chief Clerk, Inspector of Hull Material for U. S. Navy, and for mail, 142 East Fishers Avenue, Olney, Philadelphia, Pennsylvania.
- COATES, JESSE**, Consulting Engineer, and Metallurgist, 40 Ocean Avenue, Lynn, Massachusetts.
- COCHRAN, C. B.**, Chemist, State Dairy and Food Commission, and for mail, 514 South High Street, West Chester, Pennsylvania.
- COES, HAROLD V.**, Industrial Engineer, 5901 Wayne Avenue, Germantown, Philadelphia, Pennsylvania.
- COFFIN, C. A.**, Chairman of the Board, General Electric Company, 120 Broadway, New York City, New York.
- COLBY, ALBERT LADD**, Consulting Engineer, 447 Brighton Street, Bethlehem, Pennsylvania.
- COLE, FRANCIS J.**, Chief Consulting Engineer, American Locomotive Company, and for mail, 640 South Hill Avenue, P. O. Box 459, Pasadena, California.
- COLLINGWOOD, J. REED**, Buyer, Fels and Company, and for mail, 510 South 41st Street, Philadelphia, Pennsylvania.
- COLLINS, ARTHUR L.**, Test Engineer, 5616 Crowson Street, Germantown, Philadelphia, Pennsylvania.
- COLLINS, CHARLES RUSSELL**, Consulting Engineer, 805 Lowman Building, Seattle, Washington.
- COLLINS, HENRY H.**, Manufacturer, 226 Columbia Avenue, Philadelphia, Pennsylvania.
- COLLOM, SAMUEL H.**, President, Pennsylvania Flexible Metallic Tubing Company, 505 Abbott Building, Philadelphia, Pennsylvania.
- COLTON, SABIN, W., JR.** (Retired), Banker, Bryn Mawr, Pennsylvania.
- COLVIN, CHARLES H.**, Mechanical Engineer, 61 Poplar Street, Brooklyn, New York.
- COLVIN, FRED H.**, Editor and Mechanical Engineer, 56 North Maple Avenue, East Orange, New Jersey.
- COLVIN, HENRY FRED, 2nd**, Student, 56 North Maple Avenue, East Orange, New Jersey.
- COLWELL, ROBERT C.**, Professor of Physics, Geneva College, and for mail, 3101 College Avenue, Beaver Falls, Pennsylvania.
- COMEY, Dr. ARTHUR M.**, Chemist, 380 Mt. Auburn St., Cambridge, Massachusetts.
- CONAWAY, JOHN F.**, Secretary and Treasurer, National Umbrella Frame Company, 30th and Thompson Streets, Philadelphia, Pennsylvania.
- CONDUCT, G. H.**, Consulting Mechanical and Electrical Engineer, 922 Central Avenue, Plainfield, New Jersey.
- CONN, CHARLES F.**, President, Giant Portland Cement Company, Pennsylvania Building, Philadelphia, Pennsylvania.
- CONNABLE, FRANK L.**, Vice President, E. I. du Pont de Nemours and Company, 622 du Pont Building, Wilmington, Delaware.
- CONVERSE, WILLIAM A.**, Chemical Engineer, Dearborn Chemical Company, McCormick Building, Chicago, Illinois.
- COOKE, MORRIS LLEWELLYN**, Consulting Engineer in Management, Acting Director, The Utilities Bureau, 1009 Finance Building, and for mail, 401 West Walnut Lane, Germantown, Philadelphia, Pennsylvania.
- COOLEY, MORTIMER E.**, Dean, Colleges of Engineering and Architecture, Engineering Building, University of Michigan, Ann Arbor, Michigan.
- COOPER, HENRY**, Manufacturer of Olive Oil, 403 East Valerio Street, Santa Barbara, California.
- COPE, THOMAS D.**, Assistant Professor of Physics, Randal Morgan Laboratory of Physics, University of Pennsylvania, Philadelphia, Pennsylvania.

- COPPAGE, BENJAMIN DENVER**, Production Engineer, Levgor Structural Company, New York City, and for mail, 14 Willard Street, Wilmington, Delaware.
- COPPAGE, G. L.**, Assistant Works Manager, The Pusey and Jones Company, Wilmington, Delaware.
- CORNELIUS, CLARENCE E.**, Salesman, 222 West Hottter Street, Germantown, Philadelphia, Pennsylvania.
- CORNELIUS, JOHN C., JR.**, Architect, 420 West Price Street, Germantown, Philadelphia, Pennsylvania.
- CORNELIUS, JUSTICE C.**, Civil Engineer, 821 Lehigh Street, Easton, Pennsylvania.
- COSTER, EDWARD L.**, Literary Mechanical Engineer, Katonah, New York.
- COTTRELL, JAMES W.**, Dealer in Automobiles, P. O. Box 302, Hammonton, New Jersey.
- COWAN, HENRY B.**, District Engineer, 502 North 39th Street, Philadelphia, Pennsylvania.
- COWAN, WILLIAM ARTHUR**, Assistant Chief Chemist, National Lead Company, 129 York Street, Brooklyn, New York.
- COWLES, ALFRED H.**, President, Electric Smelting and Aluminum Company, Sewaren, New Jersey.
- COX, J. D.**, President, Cleveland Twist Drill Company, Cleveland, Ohio.
- COX, JOHN L.**, Mechanical Engineer, 12 Summit Street, Chestnut Hill, Philadelphia, Pennsylvania.
- COX, WALTER**, President, Pennsylvania Wire Glass Company, Pennsylvania Building, Philadelphia, Pennsylvania.
- CRAGO, WILLIAM H.**, Civil Engineer, in care of Fajardo Sugar Company, Fajardo, Porto Rico.
- CRAMP, THEODORE W.**, Ship Builder, 816 Commercial Trust Building, Philadelphia, Pennsylvania.
- CRAMPTON, GEORGE S.**, Physician, 1700 Walnut Street, Philadelphia, Pennsylvania.
- CRAWFORD, D. F.**, General Manager, Pennsylvania Lines West of Pittsburgh, 5243 Ellsworth Avenue, Pittsburgh, Pennsylvania.
- CREIGHTON, H. JERMAIN**, Assistant Professor of Chemistry, Swarthmore College, Swarthmore, Pennsylvania.
- CRENSHAW, Dr. JAMES L.**, Professor of Physical Chemistry, Bryn Mawr, Pennsylvania.
- CRISFIELD, J. A. P.**, Mechanical Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- CROASDALE, JOHN P.**, Attorney-at-Law, 1011 Chestnut Street, Philadelphia, Pennsylvania.
- CROOK, ALFRED**, Vice President and General Manager, Philadelphia Roll and Machine Company, 25th Street and Washington Avenue, Philadelphia, Pennsylvania.
- CROSMAN, J. HERON, Jr.**, Assistant Vice-President, The Bell Telephone Company of Pennsylvania, 1631 Arch Street, Philadelphia, Pennsylvania.
- CROW, E. Z.**, Chickasaw Shipbuilding & Car Company, P. O. Drawer 428, Chickasaw Branch, Mobile, Alabama.
- CROWELL, WALTER S.**, Chemical Engineer, Oak Lane, Philadelphia, Pennsylvania.
- CULLEN, GEORGE S.**, Insurance, 4504 Springfield Avenue, Philadelphia, Pennsylvania.
- CUMMINGS, J. H.**, President, John B. Stetson Company, Philadelphia, Pennsylvania.
- CUNNINGHAM, J. L.**, Superintendent of Motive Power, Pennsylvania Railroad Company, Pittsburgh, Pennsylvania.
- CURRAN, G. W.**, Secretary, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- CURTIS, CYRUS H. K.**, Curtis Publishing Building, Philadelphia, Pennsylvania.
- CURTISS, ELLIOT**, President and Treasurer, The United States Metallic Packing Company, 429 North 13th Street, Philadelphia, Pennsylvania.
- CURWEN, SAMUEL M.**, President, J. G. Brill Company, and for mail, Haverford, Pennsylvania.
- CUSHMAN, Dr. ALLERTON S.**, Director, The Institute of Industrial Research, 1845 B. Street, N. W., Washington, D. C.
- CUYLER, THOMAS DE WITT**, Attorney-at-Law, Arcade Building, Philadelphia, Pennsylvania.
- DACOSTA, J. CHALMERS, 3rd**, Mechanical Engineer, 1529 Pine Street, Philadelphia, Pennsylvania.
- DAILY, FRANCIS X.**, Engineer, The Bell Telephone Company of Pennsylvania, and for mail, 14 Athens Avenue, Ardmore, Pennsylvania.
- DANNENBAUM, HERMAN N.**, Manufacturer, Vice President, National Ammonia Company, Frankford, Philadelphia, Pennsylvania.
- DASHIELL, B. J., JR.**, Consulting Engineer, Irvington, Baltimore, Maryland.

- WILCOX, CHARLES H., AND CARLETON, CYRUS.
Automatic Tension and Improved Sewing Machines.—1875.
- WILLANS, P. W.
Steam Engine.—1895.
- WILLIAMS, C. D.
Revolving Show Window.—1892.
- WILLIAMS, JOHN N.
Typewriting Machine.—1897.
- WILLMUNDER, H.
Swivel Loom.—1898.
- WILLS, SAMUEL.
Journal Bearing and Car Axle-Box.—1885.
- WINSLOW, S. E.
Pivot Scale Beam.—1840.
- WIRT, CHARLES.
Rheostat.—1902.
- WOOD, R. W.
Diffraction Color Photography.—1907.
- WOOD, THOMAS.
Fountain Pen.—1839.
- WOODBURY, C. J. H.
Electric Light Main Testing Apparatus.—1884.
- WOODRUFF, W. N.
System of Keying for Machinery.—1888.
- WOOTTEN, J. E.
Locomotive and Boiler.—1890.
- WURTZ, A. J.
Lightning Arrestors and Non-Arcing Metal.—1894.
- YARYAN, H. T.
System of Evaporation in Vacuo.—1886.
- YEOMANS, LUCIEN I.
Method of Machine Construction.—1917.
- ZIEGLER, G. W.
Trestles and Scaffolding.—1888.

TERMS AND PRIVILEGES OF MEMBERSHIP

The members of the Institute are divided into the following classes, viz.: *Resident Members, Stockholders, Life Members, Permanent Members, Non-resident and Associate Members.*

Any one interested in the purposes and objects of the Institute and expressing a willingness to further the same may become a member when proposed by a member in good standing and elected by the Board of Managers.

Terms.—Resident members pay Fifteen Dollars each year. The payment of Two Hundred Dollars in any one year secures Life Membership, with exemption from annual dues.

Stock.—Second-class stockholders pay an annual tax of Twelve Dollars per share, and the holder of one share is entitled by such payment to the privileges of membership.

Privileges.—Each contributing member (including non-residents) and adult holder of second-class stock is entitled to participate in the meetings of the Institute, to use the Library and Reading Room, to vote at the Annual Election for officers, to receive tickets to the lectures for himself and friend, to attend the Section meetings and to receive one copy of the JOURNAL free of charge, except associate members, who may not take part in elections.

Permanent Members.—The Board of Managers may grant to any one who shall in any one year contribute to the Institute the sum of One Thousand Dollars a permanent membership, transferable by will or otherwise.

Non-resident Members.—Newly elected members residing permanently at a distance of twenty-five miles or more from Philadelphia may be enrolled as Non-resident Members, and are required to pay an entrance fee of Five Dollars, and Five Dollars annually. Non-resident Life Membership, \$75.00.

Contributing members, if eligible, under the non-resident clause, on making request therefor, may be transferred to the non-resident class by vote of the Board of Managers, and are required to pay Five Dollars annually.

Associate Members.—Associate members are accorded all the privileges of the Institute, except the right to vote or hold office, upon the payment of annual dues of Five Dollars. This class of membership is limited to persons between the ages of seventeen and twenty-five years. Upon reaching the age limit they become eligible to the other classes of membership.

Resignations must be made in writing, and dues must be paid to the date of resignation.

MEMBERSHIP DIRECTORY

HONORARY MEMBERS

- Brigadier General **JAMES ALLEN**, U.S.A. (Retired), Army and Navy Club, Washington, D. C.
Colonel **GEORGE L. ANDERSON**, U.S.A. (Retired),
Prof. **SVANTE AUGUST ARRHENIUS**, Nobel Institute, Stockholm, Sweden.
Brigadier General **JOHN J. CARTY**, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
Prof. **CHARLES F. CHANDLER**, Columbia University, New York City, New York.
Sir **JAMES DEWAR**, The Royal Institution, London, W. 1., England.
Mr. **THOMAS A. EDISON**, Orange, New Jersey.
Prof. **CHARLES FABRY**, Professor of Physics, University of Paris, 1 Rue Victor-Cousin, Paris (5e), France.
Prof. **GEORGE FORBES**, No. 11 Little College Street, Westminster, S. W., London, England.
Prof. **HENDRIK A. LORENTZ**, Zylweg 76, Haarlem, Holland.
Senator **GUGLIELMO MARCONI**, Royal Italian Senate, Rome, Italy.
Dr. **T. C. MENDENHALL**, Ravenna, Ohio.
Dr. **RALPH MODJESKI**, 818 Widener Building, Philadelphia, Pennsylvania.
Rear Admiral **JOSEPH B. MURDOCK**, U.S.N. (Retired), Danbury, New Hampshire.
Prof. **HEIKE KAMERLINGH ONNES**, University of Leiden, Leiden, Holland.
Hon. Sir **CHARLES A. PARSONS**, 6 Windsor Terrace, Newcastle-On-Tyne, England.
General **JOHN J. PERSHING**, War Department, Washington, D. C.
Mr. **RALPH W. POPE**, 570 Cherry Street, Elizabeth, New Jersey.
Prof. **THEODORE WILLIAM RICHARDS**, Wolcott Gibbs Memorial Laboratory, Harvard University, Cambridge, Massachusetts.
Rear Admiral **WILLIAM S. SIMS**, U.S.N., General Board, Naval War College, Newport, Rhode Island.
Mr. **FRANK J. SPRAGUE**, Consulting Engineer, President, Sprague Safety Control & Signal Corporation, 421 Canal Street, New York City, New York.
Major-General **GEORGE OWEN SQUIER**, War Department, Washington, D. C.
Rear Admiral **DAVID WATSON TAYLOR**, Bureau of Construction and Repair, Navy Department, Washington, D. C.
Sir **JOSEPH J. THOMSON**, Trinity College, Cambridge, England.
Prof. **WILLIAM CAWTHORNE UNWIN**, Palace Gate Mansions, Kensington, London, England.
Dr. **H. W. WILEY**, Room 1120, Woodward Building, Washington, D. C.

CORRESPONDING MEMBERS

- Professor **A. S. EVE**, McGill University, Montreal, Canada.
Mr. **T. COMMERFORD MARTIN**, 29 West 39th Street, New York City, New York.
Prof. **JOHN SEALY TOWNSEND**, New College, Oxford, England.

IN MEMORIAM

- Mr. **ISAAC B. THORN**.

MEMBERS

- ABBOTT, ROBERT R.**, Metallurgical Engineer, The Peerless Motor Car Company, Cleveland, Ohio.
ACHESON, Dr. EDWARD G., Manufacturer, Acheson Corporation, Æolian Building, 35 West 42nd Street, New York City, New York.
ADAMS, HOWARD L., Managing Director, Keystone Institute, Reading, Pennsylvania.
ADAMS, MERRITT H., Works Manager, Vim Motor Company, 23rd & Market Streets, Philadelphia, Pennsylvania.
ADDICKS, WALTER R., Vice President, Consolidated Gas Company of New York, 130 E. 15th Street, New York City, New York.

- ADSIT, CHARLES G.**, Engineer, 555 Electric and Gas Building, Atlanta, Georgia.
- AKELEY, CARL E.**, Taxidermist and Sculptor, American Museum of Natural History, 77th Street and Central Park West, New York City, New York.
- AKIMOFF, NICHOLAS W.**, Mechanical and Hydraulic Engineer, 1013 Harrison Building, Philadelphia, Pennsylvania.
- ALBRECHT, A. C.**, Vice President, North Brothers Manufacturing Company, Lehigh Avenue and American Street, Philadelphia, Pennsylvania.
- ALLAN, ANDREW, JR.**, Manufacturer of Bearing Metals, Harrison, New Jersey.
- ALLEMAN, GELLERT**, Professor of Chemistry, Swarthmore College, and for mail, 8 Whittier Place, Swarthmore, Pennsylvania.
- ALLEN, HENRY B.**, Metallurgical Engineer, 8112 St. Martins Lane, Chestnut Hill, Philadelphia, Pennsylvania.
- ALLEN, JAMES**, Brigadier General, U.S.A., Army and Navy Club, Washington, D. C.
- ALLEN, WILLIAM E.**, Clerk, 109 S. 43rd Street, Philadelphia, Pennsylvania.
- ALLEN, WILLIAM N.**, Retired Chemical Manufacturer, 557 Church Lane, Germantown, Philadelphia, Pennsylvania.
- ALSBERG, Dr. CARL L.**, Stanford University, California.
- AMES, Dr. JOSEPH S.**, Director Physical Laboratory, The Johns Hopkins University, Baltimore, Maryland.
- ANDERSON, OLAF**, Geologist, Norges Geologiske Undersokelse, Kronprinsensgt 2, Kristiania, Norway.
- ANDERSON FRANK**, Mining Engineer, 468 12th-East Street, Salt Lake City, Utah.
- ANDERSON, Colonel GEORGE L.**, U.S.A., Electrical Engineer, Address unknown.
- ANDERSON, ROBERT J.**, Metallurgical Engineer, U.S. Bureau of Mines, Experiment Station, Pittsburgh, Pennsylvania.
- ANDREAU, ROLAND L.**, Consulting Chemical Engineer and Research Chemist, Laurel Springs, New Jersey.
- ANDREWS, W. S.**, Consulting Electrical Engineer, General Electric Company, Schenectady, New York.
- ANGERER, VICTOR**, Vice-President, Taylor-Wharton Iron and Steel Company, P. O. Box 162, Ridley Park, Pennsylvania.
- ARMSTRONG, WILLIAM R.**, Clerk, Powers-Weightman-Rosengarten Company, Philadelphia, Pennsylvania.
- ARNY, Dr. H. V.**, Teacher and Chemist, 115 West 68th Street, New York City, New York.
- ARRHENIUS, SVANTE AUGUST**, Physicist, Nobel Institute, Stockholm, Sweden.
- ASEF, Dr. WALDEMAR**, Research Chemist, Research Department, Pennsylvania Salt Manufacturing Company, Greenwich Point, Philadelphia, Pennsylvania.
- ASHBROOK, Dr. DONALD S.**, Chemist, 2404 Willard Street, Wilmington, Delaware.
- ASHHURST, JOHN**, Librarian, The Free Library of Philadelphia, 13th and Locust Streets, Philadelphia, Pennsylvania.
- ASHMEAD, FRANK M.**, Civil Engineer, The Locust, Pennsylvania Avenue, Atlantic City, New Jersey.
- ATLEE, JOSHUA W.**, Naval Architect, William Cramp and Son's Ship and Engine Building Company, and for mail, Riverton, New Jersey.
- ATLEE, WALTER**, Civil Engineer, North Avenue, Mt. Washington, Maryland.
- ATTERBURY, W. W.**, Brigadier-General, Vice-President, Pennsylvania Railroad Company, Broad Street Station, Philadelphia, Pennsylvania.
- ATWATER, RICHARD M. Jr.**, Consulting Mining Engineer, Scarsdale, New York.
- AUSTIN, Dr. LOUIS W.**, U. S. Naval Radio Research Laboratory, Bureau of Standards, Washington, D. C.
- AUSTIN, W. L.**, Vice Chairman of the Board, The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- AYRES, EUGENE E., JR.**, Chemical Engineer, Sharples Specialty Company, 23rd and Westmoreland Streets, Philadelphia, Pennsylvania.
- BACHE, DANIEL T.**, Student, 2102 Pine Street, Philadelphia, Pennsylvania.
- BACON, Dr. RAYMOND FOSS**, Chemical Engineer, Chemists Building, 50 East 41st Street, New York City, New York.
- BAEKELAND, Dr. L. H.**, Research Chemist, Snug Rock, Harmony Park, Yonkers-on-Hudson, New York.
- BAKER, FRANKLIN, JR.**, Manufacturer, Wayne Avenue and Hortter Street, Germantown, Philadelphia, Pennsylvania.
- BAKER, GEORGE FALES**, Physician, 403 Lafayette Building, Philadelphia, Pennsylvania.
- BALCH, ALFRED C.**, Publisher, 227 South 6th Street, Philadelphia, Pennsylvania.
- BALCH, EDWIN S.**, Attorney-at-Law, 1634 Spruce Street, Philadelphia, Pennsylvania.
- BALDWIN, FREDERIC E.**, (Retired), 2200 Walnut Street, Philadelphia, Pennsylvania.

- BALLARD, JUDSON T.**, Chemist, 1010 Chelton Avenue, Oak Lane, Philadelphia, Pennsylvania.
- BALLARD, R. H.**, Vice President and Assistant General Manager, Southern California Edison Company, Edison Building, Los Angeles, California.
- BALLENTINE, WILLIAM L.**, Vice President, Advance Rumely Company, La Porte, Indiana.
- BALLINGER, WALTER F.**, Architect, Twelfth and Chestnut Streets, Philadelphia, Pennsylvania.
- BANCROFT, JOHN**, Manufacturer, Wilmington, Delaware.
- BANCROFT, JOSEPH**, Vice President and Treasurer, Joseph Bancroft and Sons, Wilmington, Delaware.
- BANNISTER, J. C.**, Lock Box 26, Boston, Massachusetts.
- BARNES, JAMES**, Professor of Physics, Bryn Mawr College, Bryn Mawr, Pennsylvania.
- BARNES, JOHN HAMPTON**, Attorney-at-Law, Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- BARNETT, EDWIN S.**, Wheat Starch Manufacturer, 7011 Cresheim Road, Mt. Airy, Philadelphia, Pennsylvania.
- BARNHART, G. EDWARD**, Aeronautical Engineer, 191 Marion Avenue, Pasadena, California.
- BARR, Major JOHN H.**, Mechanical Engineer, Remington Typewriter Company, 374 Broadway, New York City, New York.
- BARRINGER, DANIEL MOREAU**, Geologist and Mining Engineer, 1242 Real Estate Trust Building, Philadelphia, Pennsylvania.
- BARTH, CARL G.**, Consulting Engineer, Room 216, 10 South 18th Street, Philadelphia, Pennsylvania.
- BARTLESON, T. LEES**, Chemist, E. I. du Pont de Nemours and Company, and for mail, 305 W. 19th Street, Wilmington, Delaware.
- BARTOW, EDWARD**, Chemistry Department, State University of Iowa, Iowa City, Iowa.
- BARWIS, CALVIN W.**, Civil Engineer, In care of Interior Oil and Gas Corporation, 302 East Street, Warren, Pennsylvania.
- BASFORD, G. M.**, President, Locomotive Feed Water Heater Company, Room 719, 17 East 42nd Street, New York City, New York.
- BASHORE, E. GORGAS**, Consulting Chemical Engineer, in care of Dr. J. D. Bashore, Shippensburg, Pennsylvania.
- BASSETT, WILLIAM H.**, Technical Superintendent, American Brass Company, Waterbury, Connecticut, and for mail, Cheshire, Connecticut.
- BATES, C. W.**, Electrical Engineer, Philadelphia Electric Company, and for mail, 403 N. Narberth Avenue, Narberth, Pennsylvania.
- BATES, ONWARD**, Civil Engineer, 332 South Michigan Avenue, Chicago, Illinois.
- BEACH, CHARLES S.**, Designer and Machinist, 745 Main Street, Bennington, Vermont.
- BEALE, HORACE A., JR.**, President, Parkesburg Iron Company, Parkesburg, Pennsylvania.
- BEALE, LEONARD T.**, Secretary, John T. Lewis & Brother Company, 705 Lafayette Building, Philadelphia, Pennsylvania.
- BEATH, E. R.**, Lapidist and Jeweler, 129 South 12th Street, Philadelphia, Pennsylvania.
- BECK, M. A.**, Vice President and Chief Engineer, Milwaukee Electric Crane and Manufacturing Company, 294 Greenbush Street, Milwaukee, Wisconsin.
- BECKER, IRWIN A.**, Pharmacist, in care of Michael Reese Hospital, 2839 Ellis Avenue, Chicago, Illinois.
- BELFIELD, T. BROOM**, Manufacturer, 1905 Spring Garden Street, Philadelphia, Pennsylvania.
- BELL, J. SNOWDEN**, Attorney-at-Law, P. O. Box 629, City Hall Station, New York City, New York.
- BEMENT, CLARENCE S.**, 3907 Spruce Street, Philadelphia, Pa.
- BEMENT, WILLIAM P.**, (Retired), 743 Real Estate Trust Building, Philadelphia, Pennsylvania.
- BENNETT, FREDERICK M.**, Mechanical and Electrical Engineer, 2516 Harlan Street, Philadelphia, Pennsylvania.
- BENZON, GEORGE H., JR.**, Mechanical Engineer, 252 Mather Road, Jenkintown, Pennsylvania.
- BERG, ERNST J.**, Professor of Electrical Engineering, Union College, Schenectady, New York.
- BERG, HOLGER V.**, Chemical Engineer, Newport, Delaware.
- BERLINER, EMILE**, Engineer, 1458 Columbia Road, Washington, D. C.
- BERLINER, HERBERT S.**, Engineer, in care of Berliner Gramophone Company, Montreal, Canada.
- BERRESFORD, A. W.**, General Manager, The Cutler-Hammer Manufacturing Company, Milwaukee, Wisconsin.

- BEST, W. N.**, President, W. N. Best, Incorporated, Engineers in Caloric, 11 Broadway, New York City, New York.
- BIDDLE, CHARLES M., JR.**, First Vice President, Supplee-Biddle Hardware Company, 517 Commerce Street, Philadelphia, Pennsylvania.
- BIDDLE, ELIZABETH C.**, 400 South 15th Street, Philadelphia, Pennsylvania.
- BIDDLE, H. W.**, Stock Broker, 424 Chestnut Street, Philadelphia, Pennsylvania.
- BIDDLE, JAMES G.**, Importer of Scientific Apparatus, Wallingford, Pennsylvania.
- BIDDLE, ROBERT**, President, Biddle-Gaumer Company, 3846-36 Lancaster Avenue, Philadelphia, Pennsylvania.
- BIERBAUM, CHRISTOPHER H.**, Consulting Engineer, 1011 Mutual Life Building, Buffalo, New York.
- BIGELOW, S. LAWRENCE**, Professor of General and Physical Chemistry, University of Michigan, Ann Arbor, Michigan.
- BILGRAM, HUGO**, Machinist, 1235 Spring Garden Street, Philadelphia, Pennsylvania.
- BILLINGS, A. W. K.**, Civil, Mechanical and Electrical Engineer, Canadian and General Finance Company, Limited, Dominion Bank Building, Toronto, Canada.
- BILLOW, CLAYTON O.**, Consulting Engineer, 6800 Sheridan Road, Chicago, Illinois.
- BILYEU, THOMAS**, Mechanical Engineer, 697 E. Broadway Street, Portland, Oregon.
- BINDER, RICHARD L.**, President, K. & B. Company, Special Electrical Supplies, 931 North 8th Street, Philadelphia, Pennsylvania.
- BINNS, ARTHUR W.**, Steam Engineer, Morton, Pennsylvania.
- BIRCH, GEORGE W., JR.**, Chemist, 1414 East Columbia Avenue, Philadelphia, Pennsylvania.
- BIRKINBINE, CARL PETER**, Engineer, Room 800, Commercial Trust Building, Philadelphia, Pennsylvania.
- BLACKBURN, ARTHUR**, Grain Merchant, 315 Chamber of Commerce, and for mail, 5905 York Road, Baltimore Maryland.
- BLACKBURN, CAROLINE D.**, Chemist, 510 Midvale Avenue, Germantown, Philadelphia, Pennsylvania.
- BLAIR, A. A.**, Analytical Chemist, 406 Locust Street, Philadelphia, Pennsylvania.
- BLAKELEY, ABRAHAM G.**, Chief Chemist, Philadelphia and Reading Coal and Iron Company, Pottsville, Pennsylvania.
- BLATZ, FREDERICK J.**, Leather Manufacturer, P. O. Box 967, Wilmington, Delaware.
- BLUM, ARTHUR N.**, Mechanical Engineer, Delmar-Morris Apartments, Germantown, Philadelphia, Pennsylvania.
- BODINE, SAMUEL T.**, President, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- BOEHMKE, Dr. RODRICH**, Manufacturing Optician, 827 Spring Garden Street, Philadelphia, Pennsylvania.
- BOEKEL, J.**, Manufacturer of Metal Goods, 518 Vine Street, Philadelphia, Pennsylvania.
- BOERICKE, FELIX A.** (Retired), Bryn Athyn, Pennsylvania.
- BOERICKE, GIDEON**, Civil Engineer, Wynnewood, Pennsylvania.
- BOERICKE, JOHN J.**, Metallurgist, Secretary, Primos Chemical Company, and for mail, Merion, Pennsylvania.
- BONINE, CHARLES E.**, Consulting and Designing Engineer, Franklin Trust Building, 20 South 15th Street, Philadelphia, Pennsylvania.
- BOOZ, H. C.**, Chief Engineer, Berwind-White Coal Mining Company, 1100 Commercial Trust Building, Philadelphia, Pennsylvania.
- BORGNER, CYRUS**, Manufacturer of Fire Brick and Clay Retorts, 234 North 23rd Street, Philadelphia, Pennsylvania.
- BORIE, BEAUVEAU, JR.**, Investment Broker, 511 Chestnut Street, Philadelphia, Pennsylvania.
- BORTON, GEORGE W.**, President and General Manager, Pennsylvania Crusher Company, 1324 Stephen Girard Building, Philadelphia, Pennsylvania.
- BOSTWICK, J. VAUGHAN**, St. Davids, Pennsylvania.
- BOURNE, GEORGE L.**, Vice President, Locomotive Superheater Company, 30 Church Street, New York City, New York.
- BOWEN, SAMUEL B.**, Manufacturer, 4th Street and Sedgley Avenue, Philadelphia, Pennsylvania.
- BOWER, C. P.**, Civil Engineer, 403 Westview Avenue, Philadelphia, Pennsylvania.
- BOWER, WILLIAM HENRY**, Manufacturing Chemist, 29th Street and Grays Ferry Road, Philadelphia, Pennsylvania.
- BOYER, MURRAY C.**, Solicitor of Patents, 806 Franklin Trust Building, Philadelphia, Pennsylvania.
- BRADBURY, Dr. ROBERT H.**, Science Teacher, Southern High School, 2100 Shunk Street, Philadelphia, Pennsylvania.
- BRADDOCK-ROGERS, K.**, Trinity College, Hartford, Connecticut.

- BRADLEY, A. J.**, Manufacturer, 101 Beekman Street, New York City, New York.
- BRADSHAW, WILLIAM HENRY**, Chemist, 1241 Carpenter Street, Philadelphia, Pennsylvania.
- BRADY, EDWARD J.**, Engineering Research, 3101 Passyunk Avenue, Philadelphia, Pennsylvania.
- BREED, GEORGE**, Consulting Engineer, 277 Harvey Street, Germantown, Philadelphia, Pennsylvania.
- BREWER, Dr. J. EDWARD**, Chemist, 215 Summit Street, Norristown, Pennsylvania.
- BREWSTER, FRANK H.**, General Superintendent, United States Rubber Reclaiming Works, 180 Woodbridge Avenue, Buffalo, New York.
- BRIESEN, FRITZ V.**, Attorney-at-Law, 25 Broad Street, New York City, New York.
- BRIGHT, J. I.**, Architect, Villa Nova, Pennsylvania.
- BRIMMER, F. E.**, Chemical Manufacturer, Hydrocarbon Chemical Company, Lancaster, Pennsylvania.
- BRINLEY, CHARLES E.**, President, American Pulley Company, 4200 Wissahickon Avenue, Philadelphia, Pennsylvania.
- BRINTON, RUSSELL L.**, Carol Boulevard, Highland Park, Delaware County, Pennsylvania.
- BRINTON, WILLIAM C., JR.**, Chief Engineer, Philbrin Corporation, Kennett Square, Pennsylvania.
- BROCK, JOHN W.** Retired Attorney, 511 Bullitt Building, Philadelphia, Pennsylvania.
- BROMLEY, JOSEPH H.**, Manufacturer, Chelton and Wissahickon Avenues, Philadelphia, Pennsylvania.
- BROWN, FRANCIS SHUNK**, Lawyer, 1005 Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- BROWN, J. STANFORD**, P. O. Box 38, Black Hall, Connecticut.
- BROWN, KENNETH R.**, Chemist, Atlas Club, Tamaqua, Pennsylvania.
- BROWN, LUCIUS P.**, Chemist, Franklin, Tennessee.
- BROWN, RICHARD P.**, President, Brown Instrument Company, Wayne and Windrim Avenues, Philadelphia, Pennsylvania.
- BROWNSTEIN, BENJAMIN**, Mechanical Engineer, Elwood City, Pennsylvania.
- BRUNEL, ROGER F.**, Professor of Chemistry, Bryn Mawr College, Bryn Mawr, Pennsylvania.
- BRUNNER, FRANK A.**, Drawing Materials, 910 Filbert Street, Philadelphia, Pennsylvania.
- BRUNKER, ROBERT J.**, Banker, 1000 Walnut Street, Philadelphia, Pennsylvania.
- BRUSH, CHARLES F.**, Electrical Engineer, 3725 Euclid Avenue, Cleveland, Ohio.
- BUCHANAN, CHARLES GORDON**, Mechanical Engineer, 167 North Munn Avenue, East Orange, New Jersey.
- BUCK, H. W.**, Consulting Engineer, 49 Wall Street, New York City, New York.
- BUDD, A. VAN WYCK**, Berwyn, Prince George County, Maryland.
- BUDD, EDWARD G.**, Machinist, 502 Westview Street, Germantown, Philadelphia, Pennsylvania.
- BULLITT, JOHN C., 3rd**, 1811 Walnut Street, Philadelphia, Pennsylvania.
- BULLOCK, WILLIAM E.**, Mechanical Engineer, 29 West 39th Street, New York City, New York.
- BUMCKE, Dr. GEBHARDT**, Chemist, Trades Oil Products Company, 172-180 Frelinghuysen Avenue, Newark, New Jersey.
- BUNNELL, STERLING H.**, Consulting Mechanical Engineer, 103 Park Avenue, New York City, New York.
- BUREAU, E. W.**, Bronze Founder, S. E. Corner 23rd and Westmoreland Streets, Philadelphia, Pennsylvania.
- BURGESS, WILLIAM J.**, Pennsylvania Coal Products Company, Petrolia, Pennsylvania.
- BURHORN, EDWIN**, Engineer and Contractor, 938 Hudson Street, Hoboken, New Jersey.
- BURLINGAME, LUTHER D.**, Industrial Superintendent, Brown and Sharp Manufacturing Company, Providence, Rhode Island.
- BURNHAM, GEORGE, JR.**, (Retired), 1301 Morris Building, Philadelphia, Pennsylvania.
- BURROUGHS, JOSEPH H.**, Attorney-at-Law, 664 Bullitt Building, Philadelphia, Pennsylvania.
- BURT, MILO C.**, Chemist, 636 Water Street, Bridgeport, Connecticut.
- BURTON, THOMAS L.**, Consulting Engineer, Westinghouse Air Brake Company, 165 Broadway, New York City, New York.
- BUSH, S. P.**, Manufacturer, The Buckeye Steel Castings Company, Columbus, Ohio.
- BUSSER, FRANK S.**, Attorney-at-Law, 926 Land Title Building, Philadelphia, Pennsylvania.
- BUTLER, CHARLES N.**, Attorney-at-Law and Solicitor of Patents, 1318 Land Title Building, Philadelphia, Pennsylvania.

- BUXTON, GEORGE E., Industrial Engineer, 322 King Street, Pottstown, Pennsylvania.
- BYERS, ISAAC W., (Retired), Iron River, Michigan.
- BYRD, JOHN, Metal Worker. Address unknown.
- BYRNES, FRANK, Clerk, 535 West Montgomery Avenue, Philadelphia, Pennsylvania.
- CABOT, GEORGE E., 60 State Street, Boston, Massachusetts.
- CADWALDER, Major GOUVERNEUR, Manufacturer, O.O.R.C., Fort Washington, Pennsylvania.
- CAIRD, JAMES M., Chemist and Bacteriologist, Proctor's Building, 92 Fourth Street, Troy, New York.
- CALKINS, G. H., Manager, General Electric Company, Tenth Floor, Electric Building, Buffalo, New York.
- CALVERT, HAROLD, Electrical Engineer, President, Baird-Osterhout Company, 2114 Sansom Street, Philadelphia, Pennsylvania.
- CAMERON, Dr. FRANK K., Consulting Chemist, 46 Bransford Apartments, Salt Lake City, Utah.
- CANBY, WILLIAM W., Fruit Grower, Grants Pass, Oregon.
- CANFIELD, FREDERICK, A., Mining Engineer, Dover, New Jersey.
- CAPLES, MARTIN J., Vice President, Seaboard Airline Railway Company, and for mail, 701 Stockley Gardens, Norfolk, Virginia.
- CAPP, JOHN A., Mechanical Engineer, 62 Bedford Road, Schenectady, New York.
- CAPP, S. BUNKER, Capitalist, P. O. Box 2054, Philadelphia, Pennsylvania.
- CAPPS, W. L., Rear Admiral, U.S.N., Chief Constructor, Bureau of Construction and Repair, Navy Department, Washington, D. C.
- CARTER, EDWARD C., Consulting Engineer, 412 Greenwood Boulevard, Evanston, Illinois.
- CARTER, JOHN E., (Retired), 5356 Knox Street, Germantown, Philadelphia, Pennsylvania.
- CARTY, Brig. General, JOHN J., Vice-President and Chief Engineer, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
- CASPARI, Dr. CHARLES E., Professor of Chemistry, 2108 Locust Street, St. Louis, Missouri.
- CASSELMAN, WILLIAM S., Attorney-at-Law, Secretary, West Jersey Title and Guarantee Company, and for mail, 317 Penn Street, Camden, New Jersey.
- CATHERWOOD, WILSON, Merchant, 1708 Walnut Street, Philadelphia, Pennsylvania.
- CHAFFEE, E. LEON, Assistant Professor of Physics, Cruft Laboratory, Cambridge, Massachusetts.
- CHAMBERLAIN, G. E., Engineer, 1650 East William Street, Decatur, Illinois.
- CHAMBERS, Dr. ARTHUR DOUGLAS, Chemical Engineer, E. I. du Pont de Nemours and Company, and for mail, R. F. D. 1, Edgemoor, Delaware.
- CHAMBERS, FRANCIS T., Attorney-at-Law, 605-608 New Stock Exchange Building, 1411 Walnut Street, Philadelphia, Pennsylvania.
- CHAMBERS, J. HOWARD, Chambers Brothers Company, Founders and Machinists, and for mail, 52nd and Media Streets, Philadelphia, Pennsylvania.
- CHANCE, Dr. EDWIN M., Consulting Chemist and Engineer, 107 S. Surrey Place, Ventnor, New Jersey.
- CHANCE, Dr. HENRY M., Mining Engineer and Geologist, 839 Drexel Building, Philadelphia, Pennsylvania.
- CHANDLER, CHARLES F., Emeritus Professor of Chemistry, Columbia University, New York City, New York.
- CHANDLER, T. P., Architect, 249 South 16th Street, Philadelphia, Pennsylvania.
- CHARLTON, RICHARD C., 5017 Franklin Street, Frankford, Philadelphia, Pennsylvania.
- CHESTERMAN, FRANCIS J., Chief Engineer, The Bell Telephone Company, 261 North Broad Street, Philadelphia, Pennsylvania.
- CHRISTIANSON, A., Chief Engineer, Standard Steel Car Company, and for mail, 198 West Pearl Street, Butler, Pennsylvania.
- CHURCH, ARTHUR L., Assistant to the President, The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- CLAGHORN, CLARENCE R., Mining Engineer, 715 Continental Building, Baltimore, Maryland.
- CLAMER, F. J., (Retired), Collegeville, Montgomery County, Pennsylvania.
- CLAMER, G. H., Metallurgist and Chemist, First Vice President and Secretary, The Ajax Metal Company, Frankford Avenue and Richmond Street, Philadelphia, Pennsylvania.
- CLARK, A. WAYNE, Chemist, in care of Johnson and Johnson, New Brunswick, New Jersey.
- CLARK, BEAUVAIS, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, MISS DARTHELA, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, EDWARD B., Publisher, 61 Cedar Street, Chicago, Illinois.

- CLARK, EDWARD L.**, Chief Engineer, Commercial Truck Company, Hunting Park and Rising Sun Avenues, Philadelphia, Pennsylvania.
- CLARK, E. W.**, Banker, 321 Chestnut Street, Philadelphia, Pennsylvania.
- CLARK, FRANK H.**, Consulting Engineer and Technical Advisor, Tuscany Apartments, 40th and Stony Run Roads, Baltimore, Maryland.
- CLARK, FRANK SHAW**, Mechanical Engineer, Stone and Webster Engineering Corporation, 147 Milk Street, Boston, Massachusetts.
- CLARK, JOSEPH S.**, Attorney-at-Law, Highland Avenue, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, THEOBALD F.**, 2300 Pine Street, Philadelphia, Pennsylvania.
- CLARK, WALTON**, Engineer, Vice President, The United Gas Improvement Company, and for mail, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, MRS. WALTON**, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, WALTON, JR.**, Attorney-at-Law, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLOUD, JOHN W.**, Chairman, The Westinghouse Brake and Saxby Signal Company, Limited, 82 York Road, King's Cross, London, N. I. England.
- CLYMER, EVAN MORGAN**, Chief Clerk, Inspector of Hull Material for U. S. Navy, and for mail, 142 East Fishers Avenue, Olney, Philadelphia, Pennsylvania.
- COATES, JESSE**, Consulting Engineer, and Metallurgist, 40 Ocean Avenue, Lynn, Massachusetts.
- COCHRAN, C. B.**, Chemist, State Dairy and Food Commission, and for mail, 514 South High Street, West Chester, Pennsylvania.
- COES, HAROLD V.**, Industrial Engineer, 5901 Wayne Avenue, Germantown, Philadelphia, Pennsylvania.
- COFFIN, C. A.**, Chairman of the Board, General Electric Company, 120 Broadway, New York City, New York.
- COLBY, ALBERT LADD**, Consulting Engineer, 447 Brighton Street, Bethlehem, Pennsylvania.
- COLE, FRANCIS J.**, Chief Consulting Engineer, American Locomotive Company, and for mail, 640 South Hill Avenue, P. O. Box 459, Pasadena, California.
- COLLINGWOOD, J. REED**, Buyer, Fels and Company, and for mail, 510 South 41st Street, Philadelphia, Pennsylvania.
- COLLINS, ARTHUR L.**, Test Engineer, 5616 Crowson Street, Germantown, Philadelphia, Pennsylvania.
- COLLINS, CHARLES RUSSELL**, Consulting Engineer, 805 Lowman Building, Seattle, Washington.
- COLLINS, HENRY H.**, Manufacturer, 226 Columbia Avenue, Philadelphia, Pennsylvania.
- COLLOM, SAMUEL H.**, President, Pennsylvania Flexible Metallic Tubing Company, 505 Abbott Building, Philadelphia, Pennsylvania.
- COLTON, SABIN, W., JR.** (Retired), Banker, Bryn Mawr, Pennsylvania.
- COLVIN, CHARLES H.**, Mechanical Engineer, 61 Poplar Street, Brooklyn, New York.
- COLVIN, FRED H.**, Editor and Mechanical Engineer, 56 North Maple Avenue, East Orange, New Jersey.
- COLVIN, HENRY FRED**, 2nd, Student, 56 North Maple Avenue, East Orange, New Jersey.
- COLWELL, ROBERT C.**, Professor of Physics, Geneva College, and for mail, 3101 College Avenue, Beaver Falls, Pennsylvania.
- COMEY, Dr. ARTHUR M.**, Chemist, 380 Mt. Auburn St., Cambridge, Massachusetts.
- CONAWAY, JOHN F.**, Secretary and Treasurer, National Umbrella Frame Company, 30th and Thompson Streets, Philadelphia, Pennsylvania.
- CONDICT, G. H.**, Consulting Mechanical and Electrical Engineer, 922 Central Avenue, Plainfield, New Jersey.
- CONN, CHARLES F.**, President, Giant Portland Cement Company, Pennsylvania Building, Philadelphia, Pennsylvania.
- CONNABLE, FRANK L.**, Vice President, E. I. du Pont de Nemours and Company, 622 du Pont Building, Wilmington, Delaware.
- CONVERSE, WILLIAM A.**, Chemical Engineer, Dearborn Chemical Company, McCormick Building, Chicago, Illinois.
- COOKE, MORRIS LLEWELLYN**, Consulting Engineer in Management, Acting Director, The Utilities Bureau, 1009 Finance Building, and for mail, 401 West Walnut Lane, Germantown, Philadelphia, Pennsylvania.
- COOLEY, MORTIMER E.**, Dean, Colleges of Engineering and Architecture, Engineering Building, University of Michigan, Ann Arbor, Michigan.
- COOPER, HENRY**, Manufacturer of Olive Oil, 403 East Valerio Street, Santa Barbara, California.
- COPE, THOMAS D.**, Assistant Professor of Physics, Randal Morgan Laboratory of Physics, University of Pennsylvania, Philadelphia, Pennsylvania.

- COPPAGE, BENJAMIN DENVER**, Production Engineer, Levgor Structural Company, New York City, and for mail, 14 Willard Street, Wilmington, Delaware.
- COPPAGE, G. L.**, Assistant Works Manager, The Pusey and Jones Company, Wilmington, Delaware.
- CORNELIUS, CLARENCE E.**, Salesman, 222 West Hortter Street, Germantown, Philadelphia, Pennsylvania.
- CORNELIUS, JOHN C., JR.**, Architect, 420 West Price Street, Germantown, Philadelphia, Pennsylvania.
- CORNELIUS, JUSTICE C.**, Civil Engineer, 821 Lehigh Street, Easton, Pennsylvania.
- COSTER, EDWARD L.**, Literary Mechanical Engineer, Katonah, New York.
- COTTRELL, JAMES W.**, Dealer in Automobiles, P. O. Box 302, Hammonton, New Jersey.
- COWAN, HENRY B.**, District Engineer, 502 North 39th Street, Philadelphia, Pennsylvania.
- COWAN, WILLIAM ARTHUR**, Assistant Chief Chemist, National Lead Company, 129 York Street, Brooklyn, New York.
- COWLES, ALFRED H.**, President, Electric Smelting and Aluminum Company, Sewaren, New Jersey.
- COX, J. D.**, President, Cleveland Twist Drill Company, Cleveland, Ohio.
- COX, JOHN L.**, Mechanical Engineer, 12 Summit Street, Chestnut Hill, Philadelphia, Pennsylvania.
- COX, WALTER**, President, Pennsylvania Wire Glass Company, Pennsylvania Building, Philadelphia, Pennsylvania.
- CRAGO, WILLIAM H.**, Civil Engineer, in care of Fajardo Sugar Company, Fajardo, Porto Rico.
- CRAMP, THEODORE W.**, Ship Builder, 816 Commercial Trust Building, Philadelphia, Pennsylvania.
- CRAMPTON, GEORGE S.**, Physician, 1700 Walnut Street, Philadelphia, Pennsylvania.
- CRAWFORD, D. F.**, General Manager, Pennsylvania Lines West of Pittsburgh, 5243 Ellsworth Avenue, Pittsburgh, Pennsylvania.
- CREIGHTON, H. JERMAIN**, Assistant Professor of Chemistry, Swarthmore College, Swarthmore, Pennsylvania.
- CRENSHAW, Dr. JAMES L.**, Professor of Physical Chemistry, Bryn Mawr, Pennsylvania.
- CRISFIELD, J. A. P.**, Mechanical Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- CROASDALE, JOHN P.**, Attorney-at-Law, 1011 Chestnut Street, Philadelphia, Pennsylvania.
- CROOK, ALFRED**, Vice President and General Manager, Philadelphia Roll and Machine Company, 25th Street and Washington Avenue, Philadelphia, Pennsylvania.
- CROSMAN, J. HERON, Jr.**, Assistant Vice-President, The Bell Telephone Company of Pennsylvania, 1631 Arch Street, Philadelphia, Pennsylvania.
- CROW, E. Z.**, Chickasaw Shipbuilding & Car Company, P. O. Drawer 428, Chickasaw Branch, Mobile, Alabama.
- CROWELL, WALTER S.**, Chemical Engineer, Oak Lane, Philadelphia, Pennsylvania.
- CULLEN, GEORGE S.**, Insurance, 4504 Springfield Avenue, Philadelphia, Pennsylvania.
- CUMMINGS, J. H.**, President, John B. Stetson Company, Philadelphia, Pennsylvania.
- CUNNINGHAM, J. L.**, Superintendent of Motive Power, Pennsylvania Railroad Company, Pittsburgh, Pennsylvania.
- CURRAN, G. W.**, Secretary, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- CURTIS, CYRUS H. K.**, Curtis Publishing Building, Philadelphia, Pennsylvania.
- CURTISS, ELIOT**, President and Treasurer, The United States Metallic Packing Company, 429 North 13th Street, Philadelphia, Pennsylvania.
- CURWEN, SAMUEL M.**, President, J. G. Brill Company, and for mail, Haverford, Pennsylvania.
- CUSHMAN, Dr. ALLERTON S.**, Director, The Institute of Industrial Research, 1845 B. Street, N. W., Washington, D. C.
- CUYLER, THOMAS DE WITT**, Attorney-at-Law, Arcade Building, Philadelphia, Pennsylvania.
- DACOSTA, J. CHALMERS, 3rd**, Mechanical Engineer, 1529 Pine Street, Philadelphia, Pennsylvania.
- DAILY, FRANCIS X.**, Engineer, The Bell Telephone Company of Pennsylvania, and for mail, 14 Athens Avenue, Ardmore, Pennsylvania.
- DANNENBAUM, HERMAN N.**, Manufacturer, Vice President, National Ammonia Company, Frankford, Philadelphia, Pennsylvania.
- DASHIELL, B. J., JR.**, Consulting Engineer, Irvington, Baltimore, Maryland.

- DASHIELL, P. T.**, Assistant Engineer of Works, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- DAVIDS, R. W.**, Consulting Electrical Engineer, Merion Station, Pennsylvania.
- DAVIDSON, GEORGE M.**, Chemist and Engineer of Tests, C. & N. W. R. R., Company, Chicago, Illinois.
- DAVIS, CARLETON E.**, Civil Engineer, Chief, Bureau of Water, Room 790, City Hall, Philadelphia, Pennsylvania.
- DAVIS, CHARLES HENRY**, President and Trustee, Bass River, Cape Cod, Massachusetts.
- DAVIS, ERNEST H.**, Manager of Street Railways and Electric Light Plants, P. O. Box 424, Williamsport, Pennsylvania.
- DAWES, JAMES H.**, General Contractor, 1310 Arch Street, Philadelphia, Pennsylvania.
- DAY, Dr. ARTHUR L.**, Director Geophysical Laboratory, Carnegie Institution, Washington, D. C.
- DAY, CHARLES**, Member of Firm, Day and Zimmermann, Engineers, 611 Chestnut Street, Philadelphia, Pennsylvania.
- DAY, DAVID T.**, Petroleum Expert, 715 19th Street, N. W., Washington, D. C.
- DAY, R. H.**, Steel Manufacturer, 419 North 2nd Street, Philadelphia, Pennsylvania.
- DELANO, FREDERIC A.**, Receiver, 288 Treasury Building, Washington, D. C.
- DELANY, PATRICK B.**, Electrical Engineer, Nantucket, Massachusetts.
- DELBIDGE, THOMAS D.**, Chemist, Atlantic Refining Company, 3144 Passyunk Avenue, Philadelphia, Pennsylvania.
- DELLENBAUGH, FREDERICK S., JR.**, Electrical Engineer, Massachusetts Institute of Technology, and for mail, 91 Spooner Road, Chestnut Hill, Massachusetts.
- DEMPSEY, W. L.**, Engineer and Attorney-at-Law, 618 Perry Building, Philadelphia, Pennsylvania.
- DENIG, FRED.**, Combustion Engineer, Seaboard-By-Product Coke Company, 87 Magnolia Avenue, Jersey City, New Jersey.
- DESHONG, HOWARD T.**, Superintendent, Philadelphia Electric Company, and for mail, 9 Lansdowne Avenue, Lansdowne, Pennsylvania.
- DETWILER, J. G.**, Chemist, Room 913, The Texas Company, Houston, Texas.
- DEWAR, SIR JAMES**, Chemist, The Royal Institution, London, W. I., England.
- DICKERSON, EDWARD N.**, Attorney-at-Law, 41 Park Row, New York City, New York.
- DIDIER, PAUL**, Principal Assistant Engineer, Baltimore and Ohio Railroad Company, Conestoga Building, Wood and Water Streets, Pittsburgh, Pennsylvania.
- D'INVILLIERS, EDWARD VINCENT**, Geologist and Mining Engineer, 518 Walnut Street, Philadelphia, Pennsylvania.
- DISSTON, WILLIAM D.**, Manufacturer, in care of Henry Disston & Sons, Tacony, Philadelphia, Pennsylvania.
- DIVEN, J. M.**, Secretary, American Water Works Association, 153 West 71st Street, New York City, New York.
- DOANE, JOSEPH A.**, Chemist, Pennsylvania Salt Manufacturing Company, and for mail, 1243 Sedgley Avenue, Philadelphia, Pennsylvania.
- DOANE, SAMUEL E.**, Chief Engineer, National Lamp Works of the General Electric Company, Nela Park, Cleveland, Ohio.
- DODGE, KERN**, Consulting Engineer, Morris Building, Philadelphia, Pennsylvania.
- DOHERTY, HENRY L.**, President, Cities Service Company, 60 Wall Street, New York City, New York.
- DOLAN, THOMAS J.**, Chestnutwold Farm, Devon, Pennsylvania.
- DONALD, JAMES**, Naval Architect, Room 143, 17 Battery Place, New York City, New York.
- DONALD, WILLIAM**, Chemist and Assayer, Bloomingdale, New Jersey.
- DONNELLY, WILLIAM T.**, Consulting Engineer, Room 930, 17 Battery Place, New York City, New York.
- DONNER, WILLIAM H.**, Manufacturer, Morris Building, Philadelphia, Pennsylvania.
- DONOHUE, JOHN P.**, Coal Operator, Coulter Building, Greensburg, Pennsylvania.
- DORNER, WILLIAM F.**, 25th Ward Gas Works, Richmond and Tioga Streets, Philadelphia, Pennsylvania.
- DORR, JOHN V. N.**, Metallurgical and Chemical Engineer, President, The Dorr Company, Westport, Connecticut.
- DOUREDOURE, BERNARD L.**, Student, 103 Walnut Street, Philadelphia, Pennsylvania.
- DOUTHIRT, WALSTEIN, F.**, Vice President, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- DOW, HERBERT H.**, General Manager, The Dow Chemical Company, Midland, Michigan.
- DOYLE, WILLIAM J.**, Contractor and Builder, 1519 Sansom Street, Philadelphia, Pennsylvania.

- DRAKE, LEWIS MARVIN**, Experimental Scientist, West Fairview Avenue, Daytona, Florida.
- DREXEL, JOHN R.**, 112 Drexel Building, Philadelphia, Pennsylvania.
- DUBOSQUE, F. L.**, Superintendent of Floating Equipment, Pennsylvania Station, New York City, New York.
- DUNCAN, J. S.**, Inventor, 901 West Van Buren Street, Chicago, Illinois.
- DUNCAN, THOMAS**, President, Duncan Electric Manufacturing Company, Lafayette, Indiana.
- DUNDORE, CHARLES R.**, 8205 Seminole Avenue, Philadelphia, Pennsylvania.
- DUNN, GANO**, President, J. G. White Engineering Corporation, and for mail, 20 Washington Square, New York City, New York.
- DUNNINGTON, F. P.**, Professor of Chemistry, University of Virginia, Virginia.
- DUPONT, COLEMAN**, 808 Broome Street, Wilmington, Delaware.
- DUPONT, IRENEE**, Vice President, E. I. du Pont de Nemours and Company, Wilmington, Delaware.
- DUPONT, PIERRE S.**, President, E. I. du Pont de Nemours and Company, Wilmington, Delaware.
- DURBAN, THOMAS E.**, General Manager, Erie City Iron Works, Erie, Pennsylvania.
- D'UTASSY, GEO.**, Publisher, Cedarhurst, Long Island, New York.
- EARNSHAW, WARNER G.**, Harrison Building, Philadelphia, Pennsylvania.
- EASON, JOHN STUART**, Manufacturer and Industrial Engineer, 819 University Avenue N. E., Minneapolis, Minnesota.
- EATON, ROLAND L.**, 20 South Eighteenth Street, Philadelphia, Pennsylvania.
- EAVENSON, HOWARD N.**, Engineer, 4311 Bayard Street, Pittsburgh, Pennsylvania.
- EBERLE, E. G.**, Editor, Journal of the American Pharmaceutical Association, Room 253, Bourse Building, Philadelphia, Pennsylvania.
- EBERT, MORRIS**, Importer, 1706 Green Street, Philadelphia, Pennsylvania.
- ECKERT, SAMUEL B.**, Oil Refiner, Finance Building, 1428 South Penn Square, Philadelphia, Pennsylvania.
- ECKHARDT, E. A.**, Physicist, Bureau of Standards, Washington, D. C.
- EDGAR, C. L.**, President and General Manager, Edison Electric Illuminating Company, 70 State Street, Boston, Massachusetts.
- EDISON, THOMAS A.**, Inventor, Orange, New Jersey.
- EDWARDS, JOHN R.**, Rear Admiral, U.S.N., 620 Hope Street, Bristol, Rhode Island.
- EGLIN, W. C. L.**, Vice President and Chief Engineer, Philadelphia Electric Company, 1099 Chestnut Street, Philadelphia, Pennsylvania.
- EHRENFELD, DR. FREDERICK**, College Hall, University of Pennsylvania, Philadelphia, Pennsylvania.
- EHRET, CORNELIUS D.**, Patent Lawyer, 6911 Clearview Street, Mount Airy, Philadelphia, Pennsylvania.
- EISENLOHR, LOUIS H.**, Vice President, Otto Eisenlohr and Brothers, Inc., 932 Market Street, Philadelphia, Pennsylvania.
- ELDRED, BYRON E.**, President, Commercial Research Company, and for mail, 30 Nassau Road, Great Neck, Long Island, New York.
- ELKINS, GEORGE W.**, Vice President of Companies, Land Title Building, Philadelphia, Pennsylvania.
- ELKINTON, HOWARD W.**, Assistant Manager, Foreign Department, Philadelphia Quartz Company, 121 South Third Street, Philadelphia, Pennsylvania.
- ELKINTON, THOMAS W.**, Philadelphia Quartz Company, 121 South Third Street, Philadelphia, Pennsylvania.
- ELLIOT, EDWIN**, Foundry Superintendent, 403 West Price Street, Germantown, Philadelphia, Pennsylvania.
- ELLIOTT, HENRY M.**, 5 Northern Boulevard, Albany, New York.
- ELLIS, CARLETON**, Research Chemist and Chemical Engineer, 92 Greenwood Avenue, Montclair, New Jersey.
- ELLIS, HALCOLM**, Mechanical Engineer, Fabrique Nationale d'Armes de Guerre, Herstal-les Liege, Belgium.
- ELMENDORF, ARMIN**, Consulting Engineer, Haskelite Manufacturing Corporation, 819 Chamber of Commerce Building, Chicago, Illinois.
- ELVERSON, JAMES, JR.**, Publisher, The Philadelphia Inquirer, Philadelphia, Pennsylvania.
- EMERICK, J. M.**, Office Manager, 1501 Commonwealth Building, Philadelphia, Pennsylvania.
- EMERSON, GEORGE H.**, Chief of Motive Power and Equipment, Baltimore and Ohio Railroad, Baltimore, Maryland.
- EMERSON, HARRINGTON**, Efficiency Engineer, Room 1522, Hudson Terminal Building, 30 Church Street, New York City, New York.
- EMERY, A. H.**, Civil and Mechanical Engineer, Glenbrook, Connecticut.
- ENGELHARD, CHARLES**, Importer, Hudson Terminal Building, 30 Church Street, New York City, New York.

- EPPELSHEIMER, DANIEL, JR.**, Chief Engineer, 419 Broadway, Middletown, Ohio.
- ERHART, WILLIAM H.**, Manufacturing Chemist, 81 Maiden Lane, New York City, New York.
- ERNE, ALFRED**, Clerk, William H. Horstmann Company, 5217 Delancey Street, Philadelphia, Pennsylvania.
- ETTENGER, R. L.**, Consulting Mechanical Engineer, Southern Railway, 1300 Pennsylvania Avenue, Washington, D. C.
- EVANS, OWEN BROOKE**, Mechanical Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- EVANS, POWELL**, 2035 Washington Avenue, Philadelphia, Pennsylvania.
- EVANS, WAYNE S.**, Manufacturer of Metal Goods, 4623 Paul Street, Frankford, Philadelphia, Pennsylvania.
- EVE, A. S.**, Professor of Physics, McGill University, Montreal, Canada.
- EVANSON, J. EDWARD**, 207 South 10th Street, Philadelphia, Pennsylvania.
- FABRY, CHARLES**, Professor of Physics, University of Paris, 1 Rue Victor-Cousin, Paris (5e) France.
- FAHRIG, ERNEST**, Mining Engineer, Appalachian Range, North Carolina.
- FAIRCHILD, S. E., JR.**, Civil and Mining Engineer, Land Title Building, Philadelphia, Pennsylvania.
- FALKENAU, ARTHUR**, Industrial Engineer, 911 Park Avenue, New York City, New York.
- FARNUM, WILLIAM C.**, Mechanical Engineer, 59 Mt. Vernon Street, Fitchburg, Massachusetts.
- FARRAND, DUDLEY**, Assistant to the President, Public Service Corporation of New Jersey, 80 Park Place, Newark, New Jersey.
- FAUGHT, Dr. L. ASHLEY**, Professor of Operative Dentistry, Philadelphia Dental College, Temple University, and for mail, Medical Arts Building, Philadelphia, Pennsylvania.
- FEARING, FREDERICK C.**, Consulting Engineer, 2112 Delancey Place, Philadelphia, Pennsylvania.
- FEARON, CHARLES**, Banker, 333 Chestnut Street, Philadelphia, Pennsylvania.
- FEBIGER, C. C.**, 3421 Powelton Avenue, Philadelphia, Pennsylvania.
- FELLOWS, E. R.**, President and General Manager, The Fellows Gear Shaper Company, Springfield, Vermont.
- FELS, MAURICE**, 4305 Spruce Street, Philadelphia, Pennsylvania.
- FELS, SAMUEL S.**, Soap Manufacturer, 39th and Walnut Streets, Philadelphia, Pennsylvania.
- FELTON, EDGAR CONWAY**, President, Pennsylvania Steel Company, and for mail, Haverford, Pennsylvania.
- FELTON, JOHN G.**, Manager, Wisconsin-Minnesota Light and Power Company, La Crosse, Wisconsin.
- FELTON, SAMUEL M.**, President, Chicago Great Western Railway, 1121 Peoples Gas Building, Chicago, Illinois.
- FERGUSON, LOUIS A.**, Vice President and Electrical Engineer, Commonwealth Edison Company, Box 767, 72 West Adams Street, Chicago, Illinois.
- FERGUSON, WALTER B.**, 426 School Lane, Germantown, Philadelphia, Pennsylvania.
- FERNALD, ROBERT HEYWOOD**, Whitney Professor of Dynamical Engineering, Mechanical Engineering Department, University of Pennsylvania, Philadelphia, Pennsylvania.
- FERNANDEZ, GUY D.**, Electrical Engineer, Haddon Heights, New Jersey.
- FERREE, Dr. C. E.**, Teacher, Bryn Mawr College, Bryn Mawr, Pennsylvania.
- FINKBINER, E. W.**, Representative, E. F. Houghton Company, and for mail, 207 Market Street, Newark, New Jersey.
- FINLEY, W. H.**, President, C. & N. W. Railway Company, and for mail, 412 N. Washington Street, Wheaton, Illinois.
- FISHER, E. C.**, Vice President and General Manager, The Wilkes Boiler Company, and for mail, 308 North Jefferson Avenue, Saginaw, Michigan.
- FISHER, THOMAS**, General Manager, Berwind White Coal Mining Company, 1100 Commercial Trust Building, Philadelphia, Pennsylvania.
- FITTS, JAMES LOGAN**, Mechanical Engineer, in care of Warren Webster and Company, Point and Pearl Streets, Camden, New Jersey.
- FITZ, E. M.**, Electrical Engineer, Room 611, New First National Bank Bldg., Columbus, Ohio.
- FITZGERALD, FRANCIS A. J.**, Consulting Engineer and President, The Fitzgerald Laboratories, Niagara Falls, New York.
- FITZMAURICE, WILLIAM J., JR.**, Civil Engineer, 747 Marlyn Road, Philadelphia, Pennsylvania.
- FLANAGAN, CHARLES L.**, Insurance, Riverton, New Jersey.
- FLANAGAN, LOUIS A.**, Riverton, New Jersey.
- FLANDERS, RALPH E.**, Manager, Jones and Lamson Machine Company, and for mail, 41 Pleasant Street, Springfield, Vermont.

- FLEISHER, B. W., Manufacturer, 2301 Green Street, Philadelphia, Pennsylvania.
- FLEMING, FRANCIS P., Attorney-at-Law, 301 Heard Building, Jacksonville, Florida.
- FLETCHER, W. E., Technical Director, Atlas Powder Company, Wilmington, Delaware, and for mail, 4609 Osage Avenue, Philadelphia, Pennsylvania.
- FLYNN, JAMES A., Production Engineer, 3133 Camac Street, Philadelphia, Pennsylvania.
- FOERSTERLING, H., Chemist, in care of The Abor Farm, Jamesburg, New Jersey.
- FOOTE, ARTHUR DE WINT, Civil Engineer, North Star Mines, Grass Valley, California.
- FORBES, GEORGE, Professor of Electrical Engineering, No. 11 Little College Street, Westminster, S. W., London, England.
- FORD, BRUCE, Vice President, Electric Storage Battery Company, and for mail, 25 Summit Street, Chestnut Hill, Philadelphia, Pennsylvania.
- FORD, TERENCE J., Assistant Inspector of Ordnance U. S. Navy, and for mail, 847 E. Fourth Street, Bethlehem, Pennsylvania.
- FORREST, CHARLES N., Manager, Technical Department, Barber Asphalt Paving Company, Maurer, New Jersey.
- FORSTALL, WALTON, Gas Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- FOSTER, CHARLES E., Lawyer and Mechanical Expert, 120 St. George's Road, Ardmore, Pennsylvania.
- FRANCIS, ISAAC H., Consulting Mechanical and Electrical Engineer, Otis Building, Philadelphia, Pennsylvania.
- FRANK, EDWIN, Mechanical Engineer, 5227 Wissahickon Avenue, Germantown, Philadelphia, Pennsylvania.
- FRANKLIN, BENJAMIN, Civil and Consulting Engineer, 906-7 Crozer Building, Philadelphia, Pennsylvania.
- FRANKLIN, MILTON W., Consulting Engineer, Director of Service, General Motors Research Corporation, Dayton, Ohio.
- FRAZER, PERSIFOR, JR., Shipbuilder, Merchant Shipbuilding Company, Estey Building, Philadelphia, Pennsylvania.
- FRAZIER, GEORGE H., Banker, P. O. Box 1630, Philadelphia, Pennsylvania.
- FRAZIER, W. W., JR., Sugar Refiner, Lock Box 1630, Philadelphia, Pennsylvania.
- FREEMAN, HAROLD A., (Retired), St. Davids, Pennsylvania.
- FREEMAN, W. W., President, The Union Gas and Electric Company, 4th and Plum Streets Cincinnati, Ohio.
- FRENCH, HOWARD B., Manufacturer, 410 Callowhill Street, Philadelphia, Pennsylvania.
- FRERICHS, Dr. F. W., Vice President, Herf and Frerichs Chemical Company, St. Louis, Missouri.
- FRETZ, E. S., Manufacturer, The Light Manufacturing and Foundry Company, Pottstown, Pennsylvania.
- FRIES, HAROLD H., Manufacturing Chemist, 92 Reade Street, New York City, New York.
- FRUTCHEY, CHARLES, Superintendent, Ingersoll-Rand Company, Phillipsburg, New Jersey.
- FRY, ANN W., 6433 Jefferson Street, Germantown, Philadelphia, Pennsylvania.
- FRYER, GEORGE G., Mechanical Engineer, 203 Onondaga Avenue, Syracuse, New York.
- FUGUET, HOWARD, 360 Bullitt Building, 121-141 South Fourth Street, Philadelphia, Pennsylvania.
- FULLER, GEORGE W., Consulting Engineer, 170 Broadway, New York City, New York.
- FULWEILER, W. H., Engineer, United Gas Improvement Company, 319 Arch Street, Philadelphia, Pennsylvania.
- FUNK, N. E., Electrical Engineer, 930 Wynnewood Road, Philadelphia, Pennsylvania.
- FURNESS, GEORGE W., Millville, New Jersey.
- FURNESS, HORACE HOWARD, JR., Writer, 701 Stephen Girard Building, Philadelphia, Pennsylvania.
- FURNESS, RADCLIFFE, Engineer of Research, Midvale Steel Company, P. O. Box 1606, Philadelphia, Pennsylvania.
- GAGE, Dr. HENRY PHELPS, Physicist, Chief, Optical Division, Corning Glass Works, and for mail, 212 Chemung Street, Corning, New York.
- GALLOWAY, C. D., Mechanical Engineer, Electric Storage Battery Company, and for mail, 8409 Anderson Street, Chestnut Hill, Philadelphia, Pennsylvania.
- GARDNER, HENRY A., Chemical Engineer, Assistant Director, Institute of Industrial Research, Washington, D. C.
- GARRELS, W. L., Consulting Engineer, Manchester, Missouri.
- GARRIGUES, F. H., Life Insurance, 6806 N. Eleventh Street, Philadelphia, Pennsylvania.
- GARRISON, F. LYNWOOD, Mining Engineer, 1019 Clinton Street, Philadelphia, Pennsylvania.
- GARTLEY, WILLIAM H., Gas Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- GAZZAM, JOSEPH M., Retired Lawyer, 265 South 19th Street, Philadelphia, Pennsylvania.

- GESELL, W. H., Chemical Engineer and Manager, Lehn and Fink, Incorporated, Bloomfield, New Jersey, and for mail, 35 Christopher Street, Montclair, New Jersey.
- GEST, WILLIAM P., President, Fidelity Trust Company, 327 Chestnut Street, Philadelphia, Pennsylvania.
- GETMAN, Dr. FREDERICK H., Chemist, Hillside Laboratory, Stamford, Connecticut.
- GFROERER, A. H., Engineer, The Automatic Transportation Company, 2933-65 Main Street, Buffalo, New York.
- GHERARDI, BANCROFT, Engineer of Plant, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
- GIBBS, A. E., Chemist, Pennsylvania Salt Manufacturing Company, Widener Building, Philadelphia, Pennsylvania.
- GIBBS, E. L., Inspector, Interstate Commerce Commission, and for mail, 2004 Herschell Street, Jacksonville, Florida.
- GIBBS, WEBB L., Lubricating Engineer, 7734 South Shore Drive, Chicago, Illinois.
- GIBSON, J. J., District Manager, Westinghouse Electric and Manufacturing Company, 165 Broadway, New York City, New York.
- GILBRETH, FRANK E., Consulting Engineer, 68 Eagle Rock Way, Montclair, New Jersey.
- GILCHRIST, JOHN F., Vice President, Commonwealth Edison Company, Edison Building, Chicago, Illinois.
- GILL, JOHN D., Chemical Engineer, Atlantic Refining Company, 3144 Passyunk Avenue, Philadelphia, Pennsylvania.
- GILLMOR, R. E., Electrical Engineer, Van Rensselaer Avenue, Stamford, Connecticut.
- GILPIN, FRANCIS H., Gas Engineer, 22 Edgemont Avenue, Summit, New Jersey.
- GITTLESON, FRANK, Violinist, 28 E. Mt. Vernon Place, Baltimore, Maryland.
- GLENDINNING, ROBERT E., Banker, 400 Chestnut Street, Philadelphia, Pennsylvania.
- GLOVER, HENRY, Manufacturer, 3123 Midvale Avenue, Philadelphia, Pennsylvania.
- GLOVER, ROLFE E., JR., Chemist, 811 American National Bank Building, Richmond, Virginia.
- GOLDBAUM, JACOB S., Research Chemist, 4234 Spruce Street, Philadelphia, Pennsylvania.
- GOLDSCHMIDT, V., Professor, Heidelberg University, and for mail, Gaisberg Strasse 9, Heidelberg, Germany.
- GOLDSMITH, EDWARD, Retired Chemist, 658 North 10th Street, Philadelphia, Pennsylvania.
- GOLDSMITH, EDWIN M., Manufacturer, Friedberger-Aaron Manufacturing Company, Logan Station, Philadelphia, Pennsylvania.
- GOMBERG, MOSES, Professor of Chemistry, 725 Oxford Road, Ann Arbor, Michigan.
- GOODSPEED, ARTHUR W., Professor of Physics, University of Pennsylvania, Philadelphia, Pennsylvania.
- GOODWIN, HAROLD JR., Electrical Engineer, 3927 Locust Street, Philadelphia, Pennsylvania.
- GORDON, HUGH S., Mining Engineer, 10 Nevill Court, London, England.
- GRAFTON, E. H., Chief Chemist, Quaker City Rubber Company, Wissinoming, Philadelphia, Pennsylvania.
- GRAHAM, WALTER F., Metallurgist, 11 Laurel Street, Hartford, Connecticut.
- GRAHAM, W. M., Bookkeeper, 113 North 19th Street, Philadelphia, Pennsylvania.
- GRANBERY, J. H., Civil Engineer, 234 W. 21st Street, New York City, New York.
- GRAVELL, J. H., President, American Chemical Paint Company, 1126 South Eleventh Street, Philadelphia, Pennsylvania.
- GREEN, GEORGE ROSS, Electrical Engineer, Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- GREENE, ARTHUR M., JR., Professor of Mechanical Engineering, Princeton University, Princeton, N. J.
- GREENWOOD, RICHARD, Acting Superintendent, 1212 Allengrove Street, Frankford, Philadelphia, Pennsylvania.
- GREENWOOD, TALMA TEMPLE, Research Engineer and Patent Solicitor, 40 Court Street, Boston, Massachusetts, and for mail, East Templeton, Massachusetts.
- GRIBBEL, JOHN, Gas Meter Manufacturer, 1513 Race Street, Philadelphia, Pennsylvania.
- GRIBBEL, W. GRIFFIN, Gas Meter Manufacturer, 1513 Race Street, Philadelphia, Pennsylvania.
- GRIEST, Major THOMAS H., Civil Engineer, The Bell Telephone Company of Pennsylvania, 261 North Broad Street, Philadelphia, Pennsylvania.
- GRIFFIN, FRANK H., Chief Chemist, Viscose Company, Marcus Hook, Pennsylvania.
- GRIFFIN, MARTIN L., Chemist, Mt. Hope Finishing Company, North Dighton, Massachusetts.

- GRIFFITH, WILLIAM**, Mining Engineer and Geologist, Coal Exchange Building, Scranton, Pennsylvania.
GRIFFITH, W. O., The Clearing, Saunderstown, Rhode Island.
GRISSINGER, ELWOOD, Consulting Electrical and Mechanical Engineer, 293 Lexington Avenue, Buffalo, New York.
GROSS, Dr. A. S., Dental Surgeon, 508½ Main Street, Newton, Kansas.
GUBELMAN, FREDERICK J., President, The Regina Company, and for mail, Woodland Ave., Englewood, New Jersey.
GUCKER, F. T., Civil Engineer and Contractor, 1450 Real Estate Trust Building, Philadelphia, Pennsylvania.
GUDEMAN, Dr. EDWARD, Consulting Scientific Expert, 903 Postal Telegraph Building, Chicago, Illinois.
GUTHRIE, BAYARD, R. F. D. No. 2, Ocean Springs, Mississippi.
HAGAR, WALTER F., JR., Manufacturer, Keystone Screw Company, Yardley, Pennsylvania.
HAHN, C. V., Lieutenant, U. S. A. Ordnance Department, P. O. Box 4039, Philadelphia, Pennsylvania.
HAINES, CASPER WISTAR, Civil Engineer, 6026 Germantown Avenue, Philadelphia, Pennsylvania.
HAINES, ROBERT B., JR., Manufacturer of Rolling Mill Gauges and Haines' Automatic Micrometer, 156 West School Lane, Germantown, Philadelphia, Pennsylvania.
HAINES, WILLIAM A., Manufacturer of Fancy Leather Goods, 6445 Wissahickon Avenue, Philadelphia, Pennsylvania.
HAINES, WILLIAM J., Real Estate, 1011 Chestnut Street, Philadelphia, Pennsylvania.
HALE, HENRY S., Address unknown.
HALL, C. A., Chemical Engineer, Cresheim Arms, Allen Lane, Philadelphia, Pennsylvania.
HALL, R. T., Rear Admiral, U.S.N., Inspector of Machinery, William Cramp and Sons' Ship and Engine Building Company, Philadelphia, Pennsylvania.
HALEY, WILLIAM B., Electrical Engineer, 27 Fairview Place, corner Church Avenue, Brooklyn, New York.
HAMMER, EDWARD W., Consulting Engineer, 160 Broadway, New York City, New York.
HAMMER, WILLIAM J., Consulting Electrical Engineer, Hotel Earle, 103 Waverly Place, New York City, New York.
HAMMOND, J. M., 1429 N. 21st Street, Philadelphia, Pennsylvania.
HANTHORN, JOSEPH R., Mechanical Engineer, 4135 Girard Avenue, Philadelphia, Pennsylvania.
HARDING, WILLIAM H., Cement Manufacturer, Mechanical and Electrical Engineer, 1722 Land Title Building, Philadelphia, Pennsylvania.
HARRIS, FRANKLIN M., Brick Mason, Parkside Apartments, 40th Street and Girard Avenue, Philadelphia, Pennsylvania.
HARRISON, ALFRED C., Retired Sugar Refiner, 660 Drexel Building, Philadelphia, Pennsylvania.
HARRISON, Dr. CHARLES C., (Retired), 400 Chestnut Street, Philadelphia, Pennsylvania.
HARRISON, GEORGE L., (Retired), 1704 Locust Street, Philadelphia, Pennsylvania.
HARRISON, J. K. M., Engineer, Harrison and Company Drexel Building, Philadelphia, Pennsylvania.
HARRISON, MITCHELL, Financier, Nokesville, Virginia.
HARRISON, WILLIAM W., Merchant, 119 North 11th Street, Philadelphia, Pennsylvania.
HART, CHARLES, President, Delaware River Steel Company, Chester, Pennsylvania.
HART, EDWARD, Professor of Chemistry, Lafayette College, Easton, Pennsylvania.
HARTNESS, JAMES, President, Jones and Lamson Machine Company, and for mail, 30 Orchard Street, Springfield, Vermont.
HARTUNG, ADOLPH, Paper Merchant, 506 Race Street, Philadelphia, Pennsylvania.
HARTZEL, FRANCIS W., Carburetted Water Gas Manufacturer, 932 Cheltenham Road, Philadelphia, Pennsylvania.
HARVEY, RICHARD P., Engineer, R. F. D. No. 1, Box 16, San Mateo, California.
HASCHKA, FERD. T., Watchmaker, Tiffany and Company, and for mail, 135 West 78th Street, New York City, New York.
HASTINGS, R. C. M., Inventor, The International Telephone Company, Columbus Savings and Trust Building, Columbus, Ohio.
HATTON, T. CHALKLEY, Chief Engineer, Sewage Commission, City Hall, Milwaukee, Wisconsin.

- HAUPT, Professor LEWIS M., Consulting Engineer, Cynwyd, Pennsylvania.
- HAWKINS, J. DAWSON, Metallurgist, Colorado Springs, Colorado.
- HAWKSWORTH, FRANKLIN G., Dentist, 314 North 13th Street, Philadelphia, Pennsylvania.
- HAYWARD, NATHAN, President, American Dredging Company, Consulting Engineer, The Bell Telephone Company of Pennsylvania, 308 Chestnut Street, Philadelphia, Pennsylvania.
- HAZEN, ALLEN, Consulting Civil Engineer, 42nd Street Building, New York City, New York.
- HEILMAN, D. B., Safety Engineer, P. O. Box 453, Reading, Pennsylvania.
- HEITMANN, EDWARD, Electrical Engineer, Fairmount Hotel, 2595 Boulevard, Jersey City, New Jersey.
- HELME, WILLIAM E., Manufacturer, 1339 Cherry Street, Philadelphia, Pennsylvania.
- HENSON, EDWARD FRANCIS, Lumber Merchant, 921 North Delaware Avenue, Philadelphia, Pennsylvania.
- HEPBURN, Dr. JOSEPH SAMUEL, Biological Chemist, Hering Laboratory, Hahneman Medical College, Philadelphia, Pennsylvania.
- HERING, Dr. CARL, Consulting Electrical Engineer, 1317 Spruce Street, Philadelphia, Pennsylvania.
- HERING, Dr. RUDOLPH, Consulting Engineer, 1 West 70th Street, New York City, New York.
- HERING, WALTER E., President, The Globe Ticket Company, 112 North 12th Street, Philadelphia, Pennsylvania.
- HERR, EDWIN M., President, Westinghouse Electric and Manufacturing Company, and for mail, 140 Hutchinson Avenue, Edgewood Park, Pennsylvania.
- HERRESHOFF, NATHANIEL GREENE, Naval Architect and Marine Engineer, Herreshoff Manufacturing Company, Bristol, Rhode Island.
- HERSAM, ERNEST A., Professor of Metallurgy, Massachusetts Institute of Technology, Cambridge 39, Massachusetts.
- HERTY, Dr. CHARLES H., Chemist, 1 Madison Avenue, New York City, New York.
- HESS, WALTER G., Paint Manufacturer, 4635 Walnut Street, Philadelphia, Pennsylvania.
- HETZEL, FREDERIC V., Mechanical Engineer, P. O. Box 366, West Chester, Pennsylvania.
- HEXAMER, CHARLES A., Civil Engineer, Bullitt Building, Philadelphia, Pennsylvania.
- HICKS, THOMAS W., Manufacturer of Farm Implements, 4516 Fremont Avenue, South Minneapolis, Minnesota.
- HILL, JOHN W., Consulting Engineer, Rooms 45-46, Bodmann Building, 621 Main Street, Cincinnati, Ohio.
- HILL, ROY LINDEN, Chemist, 619 East Broad Street, Tamaqua, Pennsylvania.
- HIRE, CHARLES E., Manufacturing Chemist, 206 South 24th Street, Philadelphia, Pennsylvania.
- HITCHCOCK, Dr. FANNY R. M., 4038 Walnut Street, Philadelphia, Pennsylvania.
- HITCHINS, ALFRED B., Research Chemist, in care of AnSCO Company, Research Laboratory, Binghamton, New York.
- HOADLEY, ANTHONY DE H., Student, Union College, Schenectady, New York.
- HOADLEY, Professor GEORGE A., (Retired), Swarthmore, Pennsylvania.
- HOFSTETTER, GEORGE, Blank Book Maker, Lithographer, 247-53 South American Street, Philadelphia, Pennsylvania.
- HOLLAND, WALTER E., Research Engineer, Philadelphia Storage Battery Company, Ontario and C Streets, Philadelphia, Pennsylvania.
- HOLLANDER, CHARLES S., Chemist and Chemical Engineer, in care of Rohm and Haas Company, Bristol, Pennsylvania.
- HOLLISTER, S. C., Civil Engineer, Light Hollister and Ferguson, Land Title Building, Philadelphia, Pennsylvania.
- HOLMES, GEORGE R., Technical Journalist, 135 Garrison Avenue, Jersey City, New Jersey.
- HOLST, L. J. R., Mechanical Engineer, 6035 Carpenter Street, Philadelphia, Pennsylvania.
- HONAMAN, R. KARL, Electrical Engineer, Development and Research Department, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
- HORNSEY, JOHN W., Consulting Engineer, "The Oakes," Norton near Sheffield, England.
- HORSTMANN, W., President, Wm. H. Horstmann and Company, 5th and Cherry Streets, Philadelphia, Pennsylvania.
- HORTON, ROBERT E., Consulting Hydraulic Engineer, R. F. D. No. 1, Voorheesville, New York.

- HOSKINS, WILLIAM, Chemist, Room 2009, 11 West Monroe Street, Chicago, Illinois.
- HOUSTON, SAMUEL F., Trustee, 509 Real Estate Trust Building, Philadelphia, Pennsylvania.
- HOWARD, A. C., Gas Engineer, 61 Broadway, New York City, New York.
- HOWE, ARTHUR W., Broker, 1811 Walnut Street, Philadelphia, Pennsylvania.
- HOWE, F. P., Iron Manufacturer, 242 South 17th Street, Philadelphia, Pennsylvania.
- HOWELL, JOHN W., Engineer, Lamp Works, General Electric Company, Harrison, New Jersey.
- HOWER, Professor HARRY S., Physicist, Carnegie Institute of Technology, and for mail, 5709 Solway Street, Pittsburgh, Pennsylvania.
- HOWSON, CHARLES HENRY, Patent Solicitor and Engineer, 32 South Broad Street, Philadelphia, Pennsylvania.
- HOWSON, MISS EMILY E., Instructor in Physics, Agnes Scott College, Decatur, Georgia.
- HOWSON, HENRY, Patent Solicitor and Engineer, West End Trust Building, Philadelphia, Pennsylvania.
- HOWSON, RICHARD, 36 Mansion Avenue, Haddonfield, New Jersey.
- HUFF, ERNEST L., Electrical Engineer, Natrona, Pennsylvania.
- HUFFNAGLE, J. VINCENT, 88 Elgin Avenue, Westmont, New Jersey.
- HUHN, GEORGE A., Banker, Land Title Building, Philadelphia, Pennsylvania.
- HUMPHREYS, ALEXANDER C., Consulting Engineer, President, Stevens Institute of Technology, Hoboken, New Jersey.
- HUMPHREYS, Dr., W. J., Physicist, Weather Bureau, Washington, D. C.
- HUNT, ROBERT W., Consulting Engineer, 2200 Insurance Exchange Building, Chicago, Illinois.
- HUSTON, CHARLES L., Vice President, Lukens Steel Company, Coatesville, Pennsylvania.
- HUTCHINSON, CARY T., Consulting Engineer, 65 West 54th Street, New York City, New York.
- HUTCHINSON, S. PEMBERTON, President, Westmoreland Coal Company, 224 South 3rd Street, Philadelphia, Pennsylvania.
- HUTTINGER, W. R., Mechanical Engineer, 86 East Greenwood Avenue, Lansdowne, Pennsylvania.
- HYDE, EDWARD P., Director, Nela Research Laboratory, Nela Park, Cleveland, Ohio.
- IDE, HERBERT S., Manufacturer, Troy, New York.
- INDAHL, MAURITZ C., Mechanical Engineer, 248 East Johnson Street, Philadelphia, Pennsylvania.
- INSULL, SAMUEL, President, Commonwealth Edison Company, 72 West Adams Street, Chicago, Illinois.
- IRONS, ROBERT HATFIELD, President, Central Iron and Steel Company, Harrisburg, Pennsylvania.
- ISRAEL, JOSEPH D., District Manager, The Philadelphia Electric Company, 10th and Chestnut Streets, Philadelphia, Pennsylvania.
- ITTNER, MARTIN HILL, Chief Chemist, Colgate and Company, Jersey City, New Jersey.
- IVES, FRED E., Inventor, 1327 Spruce Street, Philadelphia, Pennsylvania.
- IVES, Dr. HERBERT E., Physicist, in care of Western Electric Company, 463 West Street, New York City, New York.
- JACKSON, A. C., Manufacturer, 4530 Tacony Street, Philadelphia, Pennsylvania.
- JACKSON, JOHN PRICE, Pennsylvania Commissioner of Labor and Industry, Harrisburg, Pennsylvania, and for mail, 129 Coulter Street, Ardmore, Pennsylvania.
- JACKSON, WILLIAM STEELL, Patent Attorney, 1001 Chestnut Street, Philadelphia, Pennsylvania.
- JACOBUS, D. S., Advisory Engineer, The Babcock and Wilcox Company, 85 Liberty Street, New York City, New York.
- JANNEY, JOSEPH A., JR., Chestnut Hill, Philadelphia, Pennsylvania.
- JEANES, ISAAC W., Room 908, Lafayette Building, Philadelphia, Pennsylvania.
- JEFFERSON, J. P., Manufacturer, P. O. Box 645, Santa Barbara, California.
- JEFFERIES, ZAY, Metallurgical Engineer, in care of Aluminum Castings Company, 2800 Harvard Avenue, Cleveland, Ohio.
- JENKINS, C. FRANCIS, Inventor, 5502 16th Street, N. W., Washington, D. C.
- JENKINS, THEODORE F., Attorney-at-Law, 1100 Franklin Bank Building, Philadelphia, Pennsylvania.
- JENNINGS, W. N., Business Photographer, 1321 Arch Street, Philadelphia, Pennsylvania.
- JOB, ROBERT, Vice President, Milton Hersey Company, Limited, 84 St. Antoine Street, Montreal, Quebec, Canada.
- JOHANSEN, ERNEST, Chemist, 439 South 51st Street, Philadelphia, Pennsylvania.

- JOHNSON, A. L.**, Vice President and General Manager, Corrugated Bar Company, 402 Mutual Life Building, Buffalo, New York.
- JOHNSON, JAMES CURTIS**, General Superintendent of Transportation, Pennsylvania Railroad Company, Broad Street Station, Philadelphia, Pennsylvania.
- JOHNSON, ERNEST EDWARD**, Professor of Physics, Northeast High School, and for mail, 201 W. Ontario Street, Philadelphia, Pennsylvania.
- JOHNSON, WALTER H.**, First Vice President Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- JONES, JONATHAN**, Engineer, Manager McClintic-Marshall Products Company, Tatagar B. N. Railway, India.
- JONES, JONATHAN R.**, Iron and Steel Manufacturer, 1800 Widener Bldg., Philadelphia, Pennsylvania.
- JONES, JULIAN D.**, Superintendent, Telegraph and Signals, Eastern Region, Pennsylvania System, Room 152, Broad Street Station, Philadelphia, Pennsylvania.
- JONES, W. CLYDE**, Attorney-at-Law, 105 West Monroe Street, Chicago, Illinois.
- JUNKERSFELD, P.**, Engineer and General Supervisor in Electric Supply Business, in care of McClellan and Junkersfeld, Incorporated, 45 William Street, New York City, New York.
- JUSTI, HENRY D.**, Manufacturer, 32nd and Spring Garden Sts., Philadelphia, Pennsylvania.
- JUSTI, HENRY M.**, 32nd and Spring Garden Sts., Philadelphia, Pennsylvania.
- KABAKJIAN, Dr. D. H.**, Assistant Professor of Physics, University of Pennsylvania, Philadelphia, Pennsylvania.
- KALTENTHALER, H. J.**, Manufacturer of Steam Specialties, 6457 Woodbine Ave., Overbrook, Philadelphia, Pennsylvania.
- KARRER, ENOCH**, Physicist, Nela Research Laboratory, Nela Park, Cleveland, Ohio.
- KAUFMAN, H. M.**, General Manager, Mutual Chemical Company of America, 110 William Street, New York City, New York.
- KEBLER, LEONARD**, President, Ward Leonard Electric Company, Mt. Vernon, New York and for mail, Avon Road, Bronxville, New York.
- KEITH, C. P.**, in care of W. G. Peters, 69 Van Antwerp Road, Schenectady, New York.
- KELLER, E. E.**, Engineer and Manufacturer, 717 Mt. Hope Avenue, Rochester, New York.
- KELLER, HARRY F.**, Educator and Chemist, 103 W. Upsal Street, Germantown, Philadelphia, Pennsylvania.
- KELLEY, Dr. GEORGE L.**, Research Chemist, 6804 McCallum Street, Philadelphia, Pennsylvania.
- KELLOGG, HOSFORD D.**, Manager, The H. B. Smith Company, 17th and Arch Streets, Philadelphia, Pennsylvania.
- KELLY, JOHN FORREST**, Electrical Engineer, 284 West Housatonic Street, Pittsfield, Massachusetts.
- KEMMERER, M. S.**, Coal Merchant, Mauch Chunk, Pennsylvania.
- KENNEDY, FRANK G., JR.**, President, Logan Iron and Steel Company, 1218 Stephen Girard Building, and for mail, 2043 Spruce Street, Philadelphia, Pennsylvania.
- KENNEDY, J. J.**, Consulting Engineer, 52 Broadway, New York City, New York.
- KENNEDY, M. C.**, Vice President, Pennsylvania Railroad Company, Broad Street Station, Philadelphia, Pennsylvania.
- KENNELLY, Dr. A. E.**, Professor of Electrical Engineering, Harvard University, Cambridge, Massachusetts.
- KENT, A. ATWATER**, Manufacturer, Ardmore, Pennsylvania.
- KENT, S. LEONARD, JR.**, Hydro-Electrics, Manayunk, Philadelphia, Pennsylvania.
- KERLIN, W. D.**, Secretary and Treasurer, Camden Forge Company, Camden, New Jersey.
- KERR, WILLIAM M.**, Manufacturer, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- KERSHNER, JEFFERSON E.**, Professor of Mathematics and Physics, Franklin and Marshall College, and for mail, 445 West Chestnut Street, Lancaster, Pennsylvania.
- KETCHAM, O. W.**, Manufacturer of Architectural Terra Cotta, 24 South Seventh Street, Philadelphia, Pennsylvania.
- KETTERLINUS, J. L.**, Lithographer, 4th and Arch Streets, Philadelphia, Pennsylvania.
- KILPATRICK, J. L.**, Aberdale Road, Bala, Pennsylvania.
- KIMBER, WILLIAM M. C.**, Manufacturer of Electrical Instruments, Leeds and Northrup Company, 4901 Stenton Avenue, Germantown, Philadelphia, Pennsylvania.
- KINEALY, JOHN HENRY**, Consulting Engineer, 503 Granite Building, St. Louis, Missouri.
- KING, CHARLES W. G.**, Mechanical Engineer, 125 Linden Avenue, Rutledge, Delaware County, Pennsylvania.
- KING, JOSEPH B., Jr.**, Assistant in Research Laboratory, Electric Storage Battery Company, and for mail, 7315 Boyer Street, Mt. Airy, Philadelphia, Pennsylvania.
- KINGSBURY, Dr. EDWIN F.**, Physicist, Western Electric Company, 463 West Street, New York City, New York.
- KINNARD, L. H.**, President, The Bell Telephone Company, 1631 Arch Street, Philadelphia, Pennsylvania.

- KINNIER, GEORGE E., Civil Engineer, 20 Red Bank Avenue, Woodbury, New Jersey.
- KIPPENBERG, HENRY, in care of Merck and Company, Rahway, New Jersey.
- KIRK, C. J., President, United States Sherardizing Company, New Castle, Pennsylvania.
- KLEMM, J. GEORGE, JR., Heating and Ventilating Engineer, Box 284, Haverford, Pennsylvania.
- KLINE, C. MAHLON, Wholesale Druggist, 429 Arch Street, Philadelphia, Pennsylvania.
- KLIPSTEIN, A., Merchant, 644-54 Greenwich Street, New York City, New York.
- KLUMPP, JOHN BARTLEMAN, Inspecting Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- KNAPP, ARTHUR, Petroleum Engineer, 210 Strathmore Road, Upper Darby, Philadelphia, Pennsylvania.
- KNAPP, I. N., Engineer, 504 Aspen Street, N. W., Takoma Park, D. C.
- KNEASS, STRICKLAND L., Mechanical Engineer, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- KNOEDLER, E. L., General Superintendent, The Welsbach Company, Gloucester, New Jersey.
- KNOX, HENRY HOBART, Mining Engineer, 160 Broadway, New York City, New York.
- KOCH, GEORGE B., General Foreman, South Altoona Foundries, Pennsylvania Railroad Company, Altoona, Pennsylvania.
- KOCH, JULIUS A., Professor of Chemistry and Dean of School of Pharmacy, University of Pittsburgh, Bluff and Pride Streets, Pittsburgh, Pennsylvania.
- KOHN, JOSEPH, Secretary and Treasurer, Universal Dental Company, 2204 Natrona Street, Philadelphia, Pennsylvania.
- KOTHNY, G. L., Consulting Engineer, C. H. Wheeler Manufacturing Company, and for mail, Woodland Road, Stratford, Pennsylvania.
- KREBS, A. S., Mechanical Engineer, Krebs Pigment and Chemical Company, Newport, Delaware.
- KREBS, H. J., President, Krebs Pigment and Chemical Company, P. O. Box 951, Wilmington, Delaware.
- KRUTTSCHNITT, J., Civil Engineer, Southern Pacific Company, 165 Broadway, New York City, New York.
- KUHN, C. HARTMAN, 202 Liberty Building, Philadelphia, Pennsylvania.
- KUTTROFF, EDWIN, President, Verona Chemical Company, North Newark, New Jersey.
- LAIRD, CLINTON N., Chemist, Canton Christian College, Canton, China.
- LANDRETH, C. P., Manufacturer, Electrolytic Purification Company, 15th Street and Lehigh Avenue, Philadelphia, Pennsylvania.
- LANE, DAVID H. (Retired), 408 Land Title Building, Philadelphia, Pennsylvania.
- LANZA, GAETANO, Engineer, Special Consultant, The Baldwin Locomotive Works, and for mail, The Montevista, 63rd and Oxford Streets, Philadelphia, Pennsylvania.
- LAUER, CONRAD, General Manager, Day and Zimmermann, and for mail, 233 West Hortic Street, Germantown, Philadelphia, Pennsylvania.
- LAVINO, E. J., Merchant, 471 Bullitt Building, Philadelphia, Pennsylvania.
- LAWALL, CHARLES H., Analytical Chemist, 636 Franklin Square, Philadelphia, Pennsylvania.
- LAWES, T. A., Mechanical Engineer, 9794 Newton Avenue, Cleveland, Ohio.
- LAWLER, G. S., Electrical Engineer, Associated Factory Mutual Fire Insurance Companies, Fort Hill Square, 184 High Street, Boston, Massachusetts.
- LE BOUTILLIER, HENRY W., Chemist, Wayne, Pennsylvania.
- LE BOUTILLIER, ROBERT, Wayne, Pennsylvania.
- LEDoux, J. W., Chief Engineer, American Pipe Manufacturing Company, 112 North Broad Street, Philadelphia, Pennsylvania.
- LEE, ELISHA, General Manager, Pennsylvania Railroad Company, Broad Street Station, Philadelphia, Pennsylvania.
- LEE, JAMES D., JR., 5929 Greene Street, Germantown, Philadelphia, Pennsylvania.
- LEE, WALTER T., Accountant, 308 Rex Avenue, Chestnut Hill, Philadelphia, Pennsylvania.
- LEEDS, MORRIS E., Manufacturer of Scientific Instruments, 4901 Stenton Avenue, Germantown, Philadelphia, Pennsylvania.
- LEFFMANN, HENRY, Chemist, 1839 North 17th Street, Philadelphia, Pennsylvania.
- LE MAISTRE, F. J., Chemical Engineer, 810 Bellevue Court Building, Philadelphia, Pennsylvania.
- LEMOINE, L. R., President, United States Cast Iron Pipe and Foundry Company, Morris Building, Philadelphia, Pennsylvania.
- LENHER, Major VICTOR, Chemist, 158 Summit Avenue, Madison, Wisconsin.
- LENKER, WILL G., Civil Engineer, 405 Chestnut Street, Sunbury, Pennsylvania.
- LESLEY, ROBERT W., Manufacturer, 612 Pennsylvania Building, Philadelphia, Pennsylvania.

- LEVY, HOWARD S., 1424 North Fifteenth Street, Philadelphia, Pennsylvania.
- LEVY, LIONEL FARADAY, Chemical Engineer, Manager, Repro Art Machinery Company, and for mail, 220 West Roberts Avenue, Philadelphia, Pennsylvania.
- LEVY, MAX, Manufacturer and Photo-Engraver, Lenox Apartments, 13th and Spruce Streets, Philadelphia, Pennsylvania.
- LEWIS, A. NELSON, Attorney-at-Law, 1811 Walnut Street, Philadelphia, Pennsylvania.
- LEWIS, DANIEL C., Agent, The Millville Manufacturing Company, Millville, New Jersey.
- LEWIS, GEORGE W., Mechanical Engineer, National Advisory Committee for Aeronautics 2722 Navy Building, Washington, D. C.
- LEWIS, HOWARD W., Banker, 1928 Spruce Street, Philadelphia, Pennsylvania.
- LEWIS, JOHN F., Attorney-at-Law, 208 South 4th Street, Philadelphia, Pennsylvania.
- LEWIS, NATHAN E., Mechanical Engineer, Babcock & Wilcox Company, 85 Liberty Street, New York City, New York.
- LEWIS, PAUL A., Physician, Director of Laboratory, The Henry Phipps Institute, 7th and Lombard Streets, Philadelphia, Pennsylvania.
- LEWIS, ROBERT B., Mechanical Engineer, 51 East Penn Street, Germantown, Philadelphia, Pennsylvania.
- LEWIS, WILFRED, Mechanical Engineer, President, The Tabor Manufacturing Company, and for mail, Rose Lane, Haverford, Pennsylvania.
- LICHTENBERG, Captain CHESTER, Electrical Engineer, 136 Waverly Place, Schenectady, New York.
- LIEB, J. W., Vice President, The New York Edison Company, 15th Street and Irving Place, New York City, New York.
- LIEBER, HUGO, Chemist, President, H. Lieber and Company, 23 East 26th Street, New York City, New York.
- LIGHTFOOT, THOMAS M., Retired Educator, Chesham, New Hampshire.
- LIHME, I. P., Chemical Engineer, The Grasselli Chemical Company, Cleveland Ohio.
- LILLIE, LEWIS, Vice President, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- LINDENTHAL, GUSTAV, Consulting Engineer, 7 Dey Street, New York City, New York.
- LIPPINCOTT, J. BERTRAM, Publisher, 229 South 6th Street, Philadelphia, Pennsylvania.
- LIPPINCOTT, JOSEPH W., Publisher, Bethayres, Pennsylvania.
- LITTLE, ARTHUR D., President, Arthur D. Little, Incorporated, 30 Charles River Road, Cambridge, Massachusetts.
- LIVERSIDGE, HORACE P., Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- LIVINGSTON, HERMAN, Hydro Carbon Engineer, Calco Chemical Company, Bound Brook, New Jersey.
- LEWELLYN, W. H., Druggist, 1518 Chestnut Street, Philadelphia, Pennsylvania.
- LLOYD, HERBERT, President, Electric Storage Battery Company, Philadelphia, Pennsylvania.
- LLOYD, JOHN URI, Manufacturing Pharmacist and Chemist, in care of The Lloyd Library, 309 West Court Street, Cincinnati, Ohio.
- LLOYD, MORTON G., Electrical Engineer, Bureau of Standards, Washington, D. C.
- LOBSEN, PEDER, Mechanical Engineer, Room No. 2, Keyser's Gade 1, Kristiania, Norway.
- LODGE, ROLLA M., Engineer and Electrician, 1149 Venango Street, Philadelphia, Pennsylvania.
- LOEB, LEO, Mechanical Engineer, Day and Zimmermann, Incorporated, 611 Chestnut Street, Philadelphia, Pennsylvania.
- LONERGAN, J. E., Brass Manufacturer, 211 Race Street, Philadelphia, Pennsylvania.
- LONGSTRETH, CHARLES, Box 326, Coronado, California.
- LONGSTRETH, EDWARD T., Manufacturer, 6805 North 11th Street, Oak Lane, Philadelphia, Pennsylvania.
- LORENTZ, HENDRIK A., Physicist, Zylweg 76, Haarlem, Holland.
- LOSS, HENRIK VON Z., Consulting Engineer, Atlantic City, New Jersey.
- LOVEJOY, J. R., Vice President, General Electric Company, Schenectady, New York.
- LOVEKIN, LUTHER D., Marine Engineer, Mill Creek Road, Ardmore, Pennsylvania.
- LOWE, ARTHUR W., Public School Teacher, 1224 Herbert Street, Frankford, Philadelphia, Pennsylvania.
- LOWER, NATHAN M., Assistant General Manager, Locomotive Stoker Company, 292 Balph Avenue, Bellevue, Pennsylvania.
- LUCKE, CHARLES EDWARD, Professor of Mechanical Engineering, Columbia University, New York City, New York.
- LUCKIESH, Dr. M., Director of Applied Science, Nela Research Laboratories, Nela Park, Cleveland, Ohio.

- LUKENS, Dr. HIRAM S., Chemist, Harrison Laboratory, University of Pennsylvania, 34th and Spruce Streets, Philadelphia, Pennsylvania.
- LUPTON, EDWARD, Manufacturer of Sheet Metal, Allegheny Avenue and Tulip Street, Philadelphia, Pennsylvania.
- LYMAN, JAMES, Consulting Engineer, Member of Firm, Sargent & Lundy, 1412 Edison Building, Chicago, Illinois.
- LYNCH, JOHN COOPER, General Superintendent of Traffic, The Bell Telephone Company, of Pennsylvania, 1631 Arch Street, Philadelphia, Pennsylvania.
- LYON, PERCY S., Chief Engineer, H. S. B. W. Cochrane Corporation, 17th Street and Allegheny Avenue, Philadelphia, Pennsylvania.
- LYSLE, FREDERIC BOWERS, Chemist-Engineer, Room 900, City Hall, Philadelphia, Pennsylvania.
- McBRIDE, THOS. C., Sales Manager, Worthington Pump and Machinery Corporation, 1516 N. American Building, Philadelphia, Pennsylvania.
- McCAFFREY, EDWARD V., File Manufacturer, McCaffrey File Company, Philadelphia, Pennsylvania.
- McCALL, JOSEPH B., President, Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- McCALL, RICHARD C., 2115 Locust Street, Philadelphia, Pennsylvania.
- McCHESNEY, JOHN M., General Manager, Keystone Leather Chemical Company, 150 West Central Avenue, Moorestown, New Jersey.
- McCLELLAND, GEORGE W., Instructor in Mathematics, 3112 Troost Avenue, Kansas City, Missouri.
- McCONNELL, FRANKLIN P., in care of Day and Zimmermann, Incorporated, 611 Chestnut Street, Philadelphia, Pennsylvania.
- McCONNELL, JACOB Y., Mechanical Engineer, 100 S. 4th Street, Darby, Pennsylvania.
- McCORMACK, H., Professor of Chemical Engineering, Armour Institute of Technology, Chicago, Illinois.
- McCOY, JOHN F., JR., Mechanical Engineer, Station Z., 3015 Midvale Avenue, Philadelphia, Pennsylvania.
- McDONALD, HUNTER, Chief Engineer, N. C. & St. L. Ry. Company, 112 Tenth Avenue, North Nashville, Tennessee.
- McFADDEN, GEORGE H., Merchant, 121 Chestnut Street, Philadelphia, Pennsylvania.
- McGEORGE, PERCY, Prætorian Building, Dallas, Texas.
- McGOWAN, J., JR., Chief Chemist, Joseph Campbell Company, 32 N. Front Street, Camden, New Jersey.
- McILHENNY, JOHN D., 17th and Clearfield Streets, Philadelphia, Pennsylvania.
- McILVAINE, A. ROBINSON, Drug Importer and Manufacturer, 15th and Hamilton Streets, Philadelphia, Pennsylvania.
- McKAIG, W. WALLACE, Mechanical Engineer, Cumberland, Maryland.
- McKEE, GEORGE M., Manufacturer, Donnacona, Quebec, Canada.
- McKEEHAN, DR. L. W., Research Physicist, Western Electric Company, 463 West Street, New York City, New York.
- McLEAN, WILLIAM L., Publisher, The Evening Bulletin, Philadelphia, Pennsylvania.
- McMEEKIN, Major C. W., 1632 Spruce Street, Berkeley, California.
- McMILLIN, EMERSON, Banker, Darlington Farms, Mahwah, New Jersey.
- McVEY, JOHN JOSEPH, Publisher & Bookseller, 1229 Arch Street, Philadelphia, Pennsylvania.
- MacBAIN, D. R., Assistant General Manager, New York Central Railroad Company, Cleveland, Ohio.
- MacBETH, NORMAN, Illuminating Engineer, 227 West 17th Street, New York City, New York.
- MacGREGOR, FRANK S., Development Department, E. I. du Pont de Nemours and Company, 452 Du Pont Building, Wilmington, Delaware.
- MACK, CARL T., Electrical Engineer, in care of Doherty Men's Club, 1329 K. Street, N. W., Washington, D. C.
- MACKENZIE, K. G., Consulting Chemist, The Texas Company, 17 Battery Place, New York City, New York.
- MacLEAN, GEORGE, President, Ives Inventions, 208 West 88th Street, New York City, New York.
- MacLEAN, MALCOLM R., Mechanical Engineer, Haverford, Pennsylvania.
- MacMURPHY, FRANKLIN, Student, Wheaton, Minnesota.
- MADEIRA, PERCY C., Coal Operator, North American Building, Philadelphia, Pennsylvania.
- MAILLOUX, Dr. C. O., Consulting Engineer, 11 Fifth Avenue, New York City, New York.
- MAITLAND, HAROLD T., Oil Chemist, Sharon Hill, Pennsylvania.

- MALLINCKRODT, E., JR.**, Manufacturing Chemist, Mallinckrodt Chemical Works, St. Louis, Missouri.
- MANWARING, ALBERT, H.**, Electrical Engineer, The Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- MARBAKER, Dr. EDWARD**, Chemist, Mellon Institute, Pittsburgh, Pennsylvania.
- MARCONTI, GUGLIELMO**, Senator, Electrical Engineer and Inventor, 31 Via Garibaldi Gianicolo, Rome, Italy.
- MARKLE, A.**, Mining Engineer, Hazleton, Pennsylvania.
- MARKLE, JOHN**, Mechanical Engineer and Coal Operator, 2 Rector Street, New York City, New York.
- MARRIOTT, R. A.**, Mechanical Engineer, 811 Higgins Building, Los Angeles, California.
- MARSHALL, THOS. H.**, Carpenter and Builder, Carpenter's Hall, 320 Chestnut Street, Philadelphia, Pennsylvania.
- MARTIN, T. COMMERFORD**, Advisory Secretary, National Electric Light Association, 29 West 39th Street, New York City, New York.
- MARTIN, THOMAS S.**, 3rd, Civil Engineer, 7205 Cresheim Road, Germantown, Philadelphia, Pennsylvania.
- MARTOCELLO, JOSEPH A.**, Manufacturer Raw Water Ice Making Appliances, 229 North 13th Street, Philadelphia, Pennsylvania.
- MASLAND, CHARLES, H.**, 2nd, Chemical Engineer, 1202 Stratford Avenue, Melrose Park, Pennsylvania.
- MASLAND, CHARLES WILLIAM**, Manufacturer, 3240 Amber Street, Philadelphia, Pennsylvania.
- MASON, CHARLES, THOMAS**, Electrical Engineer, President, Sumter Electric Company Sumter, South Carolina.
- MASON, SIDNEY**, President, Welsbach Company, Gloucester City, New Jersey.
- MASON, W. P.**, Professor of Chemistry, Rensselaer Polytechnic Institute, Troy, New York.
- MASTERS, Major FRANK M.**, Chief Inspector, 204 Locust Street, Harrisburg, Pennsylvania.
- MAXFIELD, H. H.**, General Superintendent, Pennsylvania System, Central Region, Pennsylvania Station, Pittsburgh, Pennsylvania.
- MAYER, NELSON B.**, Merchant, Hotel Marie Antoinette, Broadway and 67th Street, New York City, New York.
- MEASEY, WILLIAM MAUL**, Attorney-at-Law, 1328 Chestnut Street, and for mail, Box 208, Haverford, Pennsylvania.
- MEEKER, G. H.**, Professor of Chemistry, School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania.
- MEIGS, JOSEPH V.**, Research Chemist and Chemical Engineer, 33 Clinton Street, Malden, Massachusetts.
- MELLOR, ALFRED**, Manufacturing Chemist, 152 West Walnut Lane, Germantown, Philadelphia, Pennsylvania.
- MELLOR, NORMAN**, Manufacturer, Wayne Junction, Philadelphia, Pennsylvania.
- MELODY, MICHAEL**, Bailey Building, Philadelphia, Pennsylvania.
- MENDENHALL, Dr. T. C.**, (Retired), Ravenna, Ohio.
- MERRICK, JAMES HARTLEY**, Roxborough, Philadelphia, Pennsylvania.
- MERRICK, J. V.**, Roxborough, Philadelphia, Pennsylvania.
- MERRIMAN, THADDEUS**, Department Engineer, Board of Water Supply, Municipal Building, New York City, New York.
- MERRITT, JAMES SMITH**, Mechanical Engineer, Abington, Pennsylvania.
- MERSHON, R. D.**, Consulting Engineer, 143 Liberty Street, New York City, New York.
- MERZ, CHARLES H.**, Consulting Engineer, 32 Victoria Street, London, S. W., England.
- MERZ, EUGENE**, Manufacturer, The Heller and Merz Company, Hamburg Place, Newark, New Jersey.
- METZ, HERMAN A.**, Manufacturer and Importer of Chemicals and Dyestuffs, 122 Hudson Street, New York City, New York.
- MIDDLETON, ALBERT C.**, Director, 149 East Main Street, Moorestown, New Jersey.
- MILES, J. WALTER**, Electrical Engineer, Irwin, Pennsylvania.
- MILLER, ADOLPH W.**, Wholesale Drugs, 400 North 3rd Street, Philadelphia, Pennsylvania.
- MILLER, CASPER W.**, Physician, Wallingford, Pennsylvania.
- MILLER, FRANK P.**, Frank P. Miller Paper Company, East Downingtown, Pennsylvania.
- MILLER, FRED J.**, Factory Manager, Stockton, New Jersey.
- MILLER, GUYON**, President, Downingtown Manufacturing Company, Downingtown, Pennsylvania.
- MILLER, SIMON**, Textile Manufacturer, 901 North 16th Street, Philadelphia, Pennsylvania.

- MILLER, W. LASH**, Professor of Physical Chemistry, and for mail, 8 Hawthorne Avenue, Toronto, Canada.
- MILLIKEN, J.**, President, Pittsburgh Testing Laboratories, P. O. Box 115, Pittsburgh, Pennsylvania.
- MILLS, GEO. M.**, President, Thomas Mills and Brothers, Incorporated, 1301 North 8th Street, Philadelphia, Pennsylvania.
- MILNE, DAVID**, Manufacturer, School House Lane, Germantown, Philadelphia, Pennsylvania.
- MILNE, FRANCIS F., Jr.**, 1714 Spruce Street, Philadelphia, Pennsylvania.
- MILNER, B. B.**, Engineer of Motive Power, in care of Frazer and Company, 30 Church Street, New York City, New York.
- MINER, HARLAN S.**, Chief Chemist, Welsbach Company, Gloucester, New Jersey.
- MISSIMER, GEORGE, JR.**, Farmer, West Port Royal Avenue, Roxborough, Philadelphia, Pennsylvania.
- MITCHELL, HENRY F.**, Glazed Kid Manufacturer, 36th and Reed Streets, Philadelphia, Pennsylvania.
- MITTEN, T. E.**, Chairman of Executive Committee, Philadelphia Rapid Transit Company, 1520 Spruce Street, Philadelphia, Pennsylvania.
- MIXER, CHARLES A.**, Engineer, Rumford Falls Power Company, Rumford, Maine.
- MODJESKI, RALPH**, Consulting Civil Engineer, 818 Widener Building, Philadelphia, Pennsylvania.
- MOORE, ALFRED**, Attorney-at-Law, 618 North American Building, Philadelphia, Pennsylvania.
- MOORE, ALLEN J.**, Assistant Inspector of Ordnance, Navy Office, Bethlehem Steel Company, 511 South 6th Street, Allentown, Pennsylvania.
- MOORE, DAVID PELTON**, Patent Attorney, Warder Building, Washington, D. C.
- MOORE, HORACE E.**, Superintendent, 6429 Jefferson Street, Germantown, Philadelphia, Pennsylvania.
- MOORE, WALTER T.**, Foreign Freight Agent, 308 Bourse Building, Philadelphia, Pennsylvania.
- MOORE, W. E.**, Vice President and General Manager, West Penn Traction Company, Room 705, Union Bank Building, Pittsburgh, Pennsylvania.
- MORAN, ROBERT**, (Retired), Rosario, San Juan County, Washington.
- MORGAN, D. BRUCE**, Consulting Engineer, 805 Gotham National Bank Building, New York City, New York.
- MORGAN, MARSHALL S.**, Fidelity Trust Company, 325 Chestnut Street, Philadelphia, Pennsylvania.
- MORGAN, RANDAL**, First Vice President, United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- MORLEY, EDWARD W.**, Emeritus Professor of Chemistry, Western Reserve University, and for mail, West Hartford, Connecticut.
- MORRIS, A. SAUNDERS**, Mechanical Engineer, Haverford, Pennsylvania.
- MORRIS, EFFINGHAM B.**, Girard Trust Company, Philadelphia, Pennsylvania.
- MOYER, J. A.**, Director, Massachusetts Board of Education, State House, Boston, Massachusetts.
- MULLER, EDWARD ALBERT**, Vice President and Secretary, The King Machine Tool Company, and for mail, 839 Mitchell Avenue, Avondale, Cincinnati, Ohio.
- MÜLLER, RALPH H.**, Chemical Engineer, 485 Rogers Avenue, Brooklyn, New York.
- MUNROE, Captain CHARLES W.**, (Retired), 205 Elm Avenue, Swarthmore, Pennsylvania.
- MURDOCK, JOSEPH B.**, Rear Admiral, U. S. N., (Retired), Danbury, New Hampshire.
- MURRAY, B. L.**, Chemist, Merck and Company, Rahway, New Jersey.
- MURRAY, J. F.**, Assistant to Chief Engineer, Pennsylvania Railroad Company, 607 Broad Street Station, Philadelphia, Pennsylvania.
- MURRAY, THOMAS E.**, Consulting Electrical Engineer, 124 East 15th Street, New York City, New York.
- MURRAY, WILLIAM S.**, Consulting Engineer, 709 Sixth Avenue, New York City, New York.
- NAVARRO, JUSTO LOPEZ**, Electrical Engineer, 121 Liguerrero, Ermita, Manila, Philippine Islands.
- NEEDLES, A. C.**, General Manager, Norfolk and Western Railway Company, Roanoke, Virginia.
- NEILER, SAMUEL G.**, Consulting Mechanical and Electrical Engineer, 1409 Manhattan Building, Chicago, Illinois.
- NELL, PHILIP**, 3619 North Marshall Street, Philadelphia, Pennsylvania.
- NETHERY, JOHN E.**, (Retired), 3333 North Broad Street, Philadelphia, Pennsylvania.
- NEWBOLD, CLEMENT B.**, Banker, 511 Chestnut Street, Philadelphia, Pennsylvania.

- NICE, EUGENE E., Manufacturer, 272 South 2nd Street, Philadelphia, Pennsylvania.
- NICHOLS, CARROLL B., 1214 Widener Building, Philadelphia, Pennsylvania.
- NICHOLS, LEON W., Chemist, Glenolden, Pennsylvania.
- NICHOLS, Dr. WILLIAM H., Consulting Chemist, Chairman of Board of Directors, The Allied Chemical and Dye Corporation, 61 Broadway, New York City, New York.
- NORMAN, BRADFORD, Farmer, Newport, Rhode Island.
- NORMAN, REGINALD, Farmer, Newport, Rhode Island.
- NORRIS, GEORGE L., Tool Specialist, 222 West 2nd Street, Wilmington, Delaware.
- NORTH, R. H., North Brothers Manufacturing Company, Lehigh Avenue and American Street, Philadelphia, Pennsylvania.
- NORTHROP, EDWIN FITCH, Research Physicist, Palmer Physical Laboratory, Princeton, New Jersey.
- NOYES, STEPHEN H., Civil Engineer, Bureau of Surveys, City Hall, Philadelphia, Pennsylvania.
- NUTTING, Dr. P. G., Director of Research, 107 South Church Street, Schenectady, New York.
- OATLEY, H. B., Chief Engineer, Locomotive Superheater Company, 145 Wilson Avenue, Flushing, New York.
- OBERLY, ALBERT D., Civil Engineer, Scottsdale, Pennsylvania.
- OHMER, WILL I., President, Recording and Computing Machines Company, Dayton, Ohio.
- OLSEN, THORSTEN Y., Vice President and Treasurer, Tinius Olsen Testing Machine Company, 500 North 12th Street, Philadelphia, Pennsylvania.
- OLSEN, TINIUS, Mechanical Engineer, 500 North 12th Street, Philadelphia, Pennsylvania.
- ONNES, HEIKE KAMERLINGH, Physicist, University of Leiden, Leiden, Holland.
- ORROK, GEORGE A., Consulting Engineer, 17 Battery Place, New York City, New York, and for mail, R. F. D. No. 2, Willimantic, Connecticut.
- ORUM, MORRIS L., Manufacturer of Wood Working Machinery, 1320 North 19th Street, Philadelphia, Pennsylvania.
- OSBORNE, L. A., Vice President, Westinghouse Electric and Manufacturing Company, 165 Broadway, New York City, New York.
- OTIS, SPENCER, Manufacturer, Railway Exchange Building, Chicago, Illinois.
- OTT, G. F., President, George F. Ott Company, 325 Hansberry Street, Philadelphia, Pennsylvania.
- OUTERBRIDGE, ALEXANDER E., JR., Metallurgist, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- OWEN, BARTRAM ASHMEAD, Civil Engineer, 411 Pine Street, Philadelphia, Pennsylvania.
- PALMER, Dr. FREDERIC, JR., Professor of Physics, Haverford College, Haverford, Pennsylvania.
- PALMER, T. CHALKLEY, 2nd Vice President, American Dyewood Company, and for mail, Chester, Pennsylvania.
- PALMER, WALTER, Engineer, American Dyewood Company, and for mail, 105 West 23rd Street, Chester, Pennsylvania.
- PARDEE, CALVIN, Coal Operator, 447 Drexel Building, Philadelphia, Pennsylvania.
- PARISH, LE GRAND, President, American Arch Company, Inc., 17 East 42nd Street, New York City, New York.
- PARKER, EDWARD W., Statistician and Economist, 437 Chestnut Street, Philadelphia, Pennsylvania.
- PARKER, JOHN C., in care of Lefax, Inc., Sheridan Building, Philadelphia, Pennsylvania.
- PARR, S. W., Professor of Applied Chemistry, 107 Chemistry Building, Urbana, Illinois.
- PARSONS, Sir CHARLES A., K. C. B., 6 Windsor Terrace, Newcastle-on-Tyne, England.
- PATTERSON, C. STUART, Banker, Western Saving Fund Society of Philadelphia, 1004 Walnut Street, Philadelphia, Pennsylvania.
- PATTERSON, FRANCIS D., Physician, Chief of Division of Industrial Hygiene and Engineering, Department of Labor and Industry, Harrisburg, and for mail, 3500 Grays Ferry Road, Philadelphia, Pennsylvania.
- PATTERSON, J. EDWARD, Vice President, Arthur H. Thomas Company, 230 South 7th Street, Philadelphia, Pennsylvania.
- PAUL, H. N., Attorney-at-Law, 1815 Land Title Building, Philadelphia, Pennsylvania.
- PAUL, LAWRENCE T., Consulting Engineer, 105 Liberty Building, Broad and Chestnut Streets, Philadelphia, Pennsylvania.
- PEACOCK, S., Manufacturer of Chemist's Supplies, Wheeling Steel Building, Wheeling, West Virginia.
- PEARSON, FREDERICK J., 25 East Washington Street, Chicago, Illinois.
- PEARSON, JOSHUA A., Purchasing Agent, The United Gas Improvement Company, 1410 Arch Street, Philadelphia, Pennsylvania.

- PEASE, F. N., Chief Chemist, Pennsylvania Railroad Company, P. O. Box 503, Altoona, Pennsylvania.
- PEASE, FRANCIS G., Astronomical Engineer, Mt. Wilson Solar Observatory, Pasadena, California.
- PECK, G. L., Vice President, Personnel Department Pennsylvania System, Broad Street Station, Philadelphia, Pennsylvania.
- PEMBERTON, HENRY R., Student. Address Unknown.
- PENNOCK, GEO. L., Florist, 165 West Essex Avenue, Lansdowne, Pennsylvania.
- PENROSE, CHARLES, Electrical Engineer, in care of Day and Zimmermann, 611 Chestnut Street, Philadelphia, Pennsylvania.
- PENROSE, R. A. F., JR., Geologist, 460 Bullitt Building, Philadelphia, Pennsylvania.
- PEPPER, DAVID, Engineer, Commonwealth Building, Philadelphia, Pennsylvania.
- PEROT, T. MORRIS, JR., Malt Manufacturer, 808 Lafayette Building, Philadelphia, Pennsylvania.
- PERROT, EMILE, G., Architect and Engineer, Boyertown Building, 1211 Arch Street Philadelphia, Pennsylvania.
- PERRY, ROBERT S., President, Franklin H. Kalbfleisch Company, 31 Union Square, West, New York City, New York.
- PERSHING, General JOHN J., War Department, Washington, D. C.
- PEW, J. HOWARD, President, Sun Oil Company, and Sun Shipbuilding Company, Finance Building, Philadelphia, Pennsylvania.
- PHELAN, HUNTER C., 651 Salem Avenue, Dayton, Ohio.
- PHILIPS, EDWIN S., President, Philbrin Corporation, Kennett Square, Pennsylvania.
- PICOLET, LUCIEN E., in care of The Franklin Institute, Philadelphia, Pennsylvania.
- PIERCE, G. A., Electrical Engineer, Wm. Cramp & Sons Ship and Engine Building Company, Philadelphia, Pennsylvania.
- PITMAN, Brig. General JOHN, (Retired), 611 Berkley Avenue, Orange, New Jersey.
- PLACK, W. L., Architect and Structural Engineer, S. W. Corner 12th and Locust Streets, Philadelphia, Pennsylvania.
- PLATT, H. H., Mechanical Engineer, Scarsdale, New York.
- POPE, RALPH W., Honorary Secretary, American Institute of Electrical Engineers, 570 Cherry Street, Elizabeth, New York.
- PORTER, J. BENTON, Electrical Engineer, 1527 Spruce Street, Philadelphia, Pennsylvania.
- PORTER, ROLAND G., Gas Engineer, Swarthmore, Pennsylvania.
- POSER, Dr. M., 16 Vick Park B, Rochester, New York.
- POSTLETHWAITE, C. E., General Sales Manager, Pressed Steel Car Company, 55 Broad Street, New York City, New York.
- POTTS, JOSHUA R. H., Attorney-at-Law, 929 Chestnut Street, Philadelphia, Pennsylvania.
- POTTS, WILLIAM M., Civil Engineer, Wyebrooke, Chester County, Pennsylvania.
- PRATT, CARL D., Chemist, 412 West Broad Street, Tamaqua, Pennsylvania.
- PRICE, MAX CHARLES, Architect, Punta Gorda, Florida.
- PRICE, MORTON MOORE, Sales Agent, The Babcock and Wilcox Company, 1010 North American Building, Philadelphia, Pennsylvania.
- PURCELL, JOHN, Assistant to Vice President, Atchison, Topeka and Santa Fe Railway Company, 80 East Jackson Boulevard, Chicago, Illinois.
- QUAYLE, R., 233 North Harvey Avenue, Oak Park, Illinois.
- QUIMBY, HENRY H., Consulting Structural Engineer, 3920 Girard Avenue, Philadelphia, Pennsylvania.
- QUINN, C. H., Chief Electrical Engineer, Norfolk and Western Railway Company, Roanoke, Virginia.
- RADFORD, ROBERT, Manufacturer, 1103 Morris Building, Philadelphia, Pennsylvania.
- RAE, JOHN, Shop Engineer, Bement-Miles Works, Niles-Bement-Pond Company, and for mail, 4945 Larchwood Avenue, Philadelphia, Pennsylvania.
- RAMSBURG, C. J., Vice-President, The Koppers Company, Pittsburgh, Pennsylvania.
- RAMSEY, GEORGE W., Patent Attorney, Woolworth Building, New York City, New York.
- RAPP, I. M., Physicist, State University, Missoula, Montana.
- RAUTENSTRAUCH, WALTER, Professor of Mechanical Engineering, 43 Exchange Place, New York City, New York.
- RAYMOND, WARD, Mechanical Engineer, 908 Paxinosa Avenue, Easton, Pennsylvania.
- REA, SAMUEL, President, Pennsylvania Railroad Company, Broad Street Station, Philadelphia, Pennsylvania.
- REATH, THEODORE W., Attorney-at-Law, 1201 Commercial Trust Building, Philadelphia, Pennsylvania.
- REBER, Colonel SAMUEL, 27 Van Dam Street, New York City, New York.

- REBMANN, G. R.**, Vice President, Otis Elevator Company, 16th & Sansom Streets, Philadelphia, Pennsylvania.
- REDFIELD, ROBERT S.**, Wayne, Pennsylvania.
- REED, G. BERKELEY**, Inventor, Rowayton, Connecticut.
- REESE, CHARLES L.**, Chemical Engineer, E. I. du Pont de Nemours & Company, Wilmington, Delaware.
- REICHARDT, HENRY**, (Retired), 3581 Queen Lane, East Falls, Philadelphia, Pennsylvania.
- RENO, JESSE W.**, Consulting Engineer, 684 St. Nicholas Avenue, New York City, New York.
- REOCH, ALEXANDER ERNEST**, Electrical Engineer, The Radio Corporation of America, 233 Broadway, New York City, New York.
- RESINES, JAVIER**, Industrial Chemist, Racquet Club, Philadelphia, Pennsylvania.
- RHOADS, J. J.**, Superintendent, Pennsylvania Railroad Company, and for mail, Miller Park, Franklin, Pennsylvania.
- RICE, CHARLES D.**, Manager of Factory, Underwood Typewriter Company, 581 Capitol Avenue, Hartford, Connecticut.
- RICE, E. W. JR.**, Electrical Engineer, President, General Electric Company, Schenectady, New York.
- RICHARDS, EDGAR**, Retired Chemist, 60 Ayrault Street, Newport, Rhode Island.
- RICHARDS, THEODORE WM.**, Director, Wolcott Gibbs Memorial Laboratory, Harvard University, Cambridge, Massachusetts.
- RICHARDSON, CHARLES E.**, Engineer, Chas. E. Richardson and Company, Engineers, 18 East 60th Street, New York City, New York.
- RICKETTS, L. D.**, Mining Engineer, Warren, Arizona.
- RIDGWAY, ELLIS B.**, Manufacturer, 367 West Main Street, Coatesville, Pennsylvania.
- RIDGWAY, ROBERT**, Engineer, in care of Public Service Company, 49 Lafayette Street, New York City, New York.
- RIDGWAY, WILLIAM H.**, Civil Engineer and Manufacturer, The Craig Ridgway and Son Company, Coatesville, Pennsylvania.
- RIEHL, FRED A.**, Testing Machine Manufacturer, 1424 North 9th Street, Philadelphia, Pennsylvania.
- RIGLING, ALFRED**, Librarian, The Franklin Institute, and for mail, 4835 Haverford Avenue, Philadelphia, Pennsylvania.
- RILEY, LEWIS A.**, Civil and Mining Engineer, Lafayette Building, 437 Chestnut Street, Philadelphia, Pennsylvania.
- RILLIET, CHARLES E.**, Teacher, 4100-06 South Vermont Avenue, Los Angeles, California.
- RINGWALT, ROLAND**, Clergyman, 3016 Carman Street, Camden, New Jersey.
- RITTENHOUSE, EDWARD**, Chemical Engineer, Aldan, Pennsylvania.
- RITTER, LOUIS E.**, Consulting Civil Engineer, 1707 Marquette Building, Chicago, Illinois.
- RITTMAN, Dr. W. F.**, Chemical Engineer, Carnegie Institute of Technology, Pittsburgh, Pennsylvania.
- ROBB, RUSSELL**, Member of Firm, Stone and Webster Engineering Corporation, 147 Milk Street, Boston, Massachusetts.
- ROBERTS, WILMER**, Palmyra, New Jersey.
- ROBINSON, ANTHONY W.**, Insurance, 409 Chestnut Street, Philadelphia, Pennsylvania.
- ROBINSON, DWIGHT P.**, Consulting Engineer, 49 East 52nd Street, New York City, New York.
- ROBINSON, EDMUND G.**, Chemist, 909 Nottingham Road, Wilmington, Delaware.
- RODMAN, HUGH**, Engineer and Manufacturer, in care of Rodman Chemical Company, Verona, Pennsylvania.
- ROESSLER, FRANZ**, Manufacturing Chemist, 89 High Street, Perth Amboy, New Jersey.
- ROGERS, Dr. ALLEN**, Teacher, Pratt Institute, Brooklyn, New York.
- ROGERS, MRS. AUGENE P.**, 4007 Powelton Avenue, Philadelphia, Pennsylvania.
- ROGERS, FRANK H.**, Mechanical Engineer, William Cramp and Sons, Ship and Engine Building Company, Philadelphia, Pennsylvania.
- ROGERS, JAMES S.**, Attorney-at-Law, 701 Commonwealth Trust Building, Philadelphia, Pennsylvania.
- ROLLE, SYLVAN D.**, Draftsman, The Bell Telephone Company of Pennsylvania, and for mail, 2143 North 19th Street, Philadelphia, Pennsylvania.
- ROLLER, FRANK W.**, Electrical and Mechanical Engineer, 233 Broadway, New York City, New York.
- RONDINELLA, L. F.**, Head of Drawing and Designing, West Philadelphia High School for Boys, 48th and Walnut Streets, Philadelphia, Pennsylvania.
- ROSENBAUM, MORRIS**, Foreign Exchange, 605 South 3rd Street, Philadelphia, Pennsylvania.
- ROSENBAUM, W. A.**, Patent Attorney, 41 Park Row, New York City, New York.
- ROSENGARTEN, FRANK H.**, Chemist, 1905 Walnut Street, Philadelphia, Pennsylvania.

- ROSENGARTEN, FREDERIC, Manufacturing Chemist, P. O. Box 1625, Philadelphia, Pennsylvania.
- ROSENGARTEN, GEORGE D., Manufacturing Chemist, P. O. Box 1625, Philadelphia, Pennsylvania.
- ROSIN, JOSEPH, Chemist, Powers-Weightman-Rosengarten Company, 9th and Parrish Streets, Philadelphia, Pennsylvania.
- ROSS, T. EDWARD, Certified Public Accountant, 1209 Morris Building, Philadelphia, Pennsylvania.
- ROWLAND, CHARLES B., Vice President, Continental Iron Works, West and Calyer Streets, Brooklyn, New York.
- ROWLAND, THEODORE S., Head of Science Department, North East High School, and for mail, 6311 N. Camac Street, Philadelphia, Pennsylvania.
- RUGG, W. S., The University Club, 4439 Grant Boulevard, Pittsburgh, Pennsylvania.
- RUMBOUGH, JOHN B., Consulting Mechanical Engineer, R. F. D. No. 1, Ardan, North Carolina.
- RUMELY, W. N., 3020 Sheridan Road, Chicago, Illinois.
- RUSBY, J. M., Engineer of Tests, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- RUSSELL, CHARLES J., Manager, Sales Department, The Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- SADTLER, Dr. SAMUEL P., Consulting Chemist, 210 South 13th Street, Philadelphia, Pennsylvania.
- SADTLER, SAMUEL S., Consulting Chemist, 210 South 13th Street, Philadelphia, Pennsylvania.
- SAEGMULLER, G. N., Vice President, in care of Bausch and Lomb Optical Company, Rochester, New York.
- SALMON, FREDERICK W., Civil and Mechanical Engineer, Richmond, Virginia.
- SALOM, PEDRO G., Electro-Chemical Engineer, Commonwealth Trust Building, Philadelphia, Pennsylvania.
- SAMUEL, J. BUNFORD, Retired Iron Merchant, 1609 Spruce Street, Philadelphia, Pennsylvania.
- SANBORN, EDWARD H., Coal Mining, 1100 Commercial Trust Building, Philadelphia, Pennsylvania.
- SANDERSON, R. P. C., in care of The Baldwin Locomotive Works, 34 Victoria Street, London, England.
- SANDT, A. R., Consulting Engineer, 716-18 Metropolitan Life Building, Minneapolis, Minnesota.
- SANFORD, RUFUS H., Librarian, The Baldwin Locomotive Works, Philadelphia, Pennsylvania.
- SARGENT, C. E., Engineer, 909 20th Street, Rock Island, Illinois.
- SARGENT, HENRY B., Hardware Manufacturer, 247 Church Street, New Haven, Connecticut.
- SARTAIN, PAUL J., Physician, 2006 Walnut Street, Philadelphia, Pennsylvania.
- SARTAIN, WILLIAM, Artist, 140 West 57th Street, New York City, New York.
- SATTERTHWAITE, GEORGE, Manufacturer of Steel, in care of Tacony Steel Company, Tacony, Philadelphia, Pennsylvania.
- SAUER, FRANK H., Draftsman, 1307 Atlantic Avenue, Camden, New Jersey.
- SAUNDERS, WALTER M., Analytical and Consulting Chemist, 20 Dewey Street, Olneyville, Providence, Rhode Island.
- SAUNDERS, WILLIAM E., Librarian, U. G. I. Building, Broad and Arch Streets, Philadelphia, Pennsylvania.
- SAWTELLE, WILLIAM OTIS, Professor of Physics, Haverford College, Haverford, Pennsylvania.
- SCATTERGOOD, HENRY W., Manufacturer, 530 Land Title Building, Philadelphia, Pennsylvania.
- SCHAEFER, GEORGE F., 5th and Cherry Streets, Philadelphia, Pennsylvania.
- SCHEHL, OSCAR L., Mechanical Engineer, 1631 Girard Avenue, Philadelphia, Pennsylvania.
- SCHLAFGE, WILLIAM S., General Mechanical Superintendent, Erie Railroad Company, 50 Church Street, New York City, New York.
- SCHLICKE, C. P., Treasurer and Secretary, 31 Plaza Street, Brooklyn, New York.
- SCHROM, OSCAR G., Mechanical Engineer, 6017 Nassau Street, Philadelphia, Pennsylvania.
- SCOTT, WM. M., Draftsman, Box 76, Radnor, Pennsylvania.
- SEELY, LESLIE B., Teacher, 5918 Pulaski Avenue, Germantown, Philadelphia, Pennsylvania.
- SEIBERLING, F. A., Manufacturer, 41 East Mill Street, Akron, Ohio.
- SELGA, M., Meteorologist and Astronomer, Manila Observatory, Manila, Philippine Islands.
- SELLERS, ALEXANDER, Manufacturer, 1600 Hamilton Street, Philadelphia, Pennsylvania.

- SELLERS, HORACE W.**, Architect, Ardmore, Pennsylvania.
- SELLERS, HOWARD**, Millbourne House, Millbourne, Pennsylvania.
- SELLERS, RICHARD**, Bellevue, Delaware.
- SELLERS, RICHARD C.**, Civil Engineer, Swarthmore, Pennsylvania.
- SELLERS, MRS. WILLIAM**, Bellevue, Delaware.
- SELLERS, WILLIAM F.**, Manufacturer of Water Tube Boilers, Edge Moor, Delaware.
- SEVERY, MELVIN L.**, Inventor and Author, 431 South Berendo Street, Los Angeles, California.
- SHACKELFORD, BENJAMIN E.**, Physicist, Westinghouse Lamp Company, Bloomfield, New Jersey.
- SHAND, A. C.**, Civil Engineer, Narberth, Pennsylvania.
- SHARER, CARL W.**, Superintendent of Equipment, The Keystone Telephone Company, and for mail, 446 East Walnut Lane, Germantown, Philadelphia, Pennsylvania.
- SHARP, Dr. CLAYTON H.**, Technical Director, Electrical Testing Laboratories, 80th Street and East End Avenue, New York City, New York.
- SHARP, W. H.**, Paper Manufacturer, The Wellington, 19th and Walnut Streets, Philadelphia, Pennsylvania.
- SHARPLES, STEPHEN P.**, Chemical Engineer, 22 Concord Avenue, Cambridge, Massachusetts.
- SHATTUCK, A. F.**, Chief Chemist, Solvay Process Company, and for mail, 614 Canon Drive, Beverly Hills, California.
- SHATTUCK, JOHN D.**, Gas Engineer, Chester, Pennsylvania.
- SHIMER, PORTER W.**, Chemist and Metallurgist, Easton, Pennsylvania.
- SHMIDHEISER, W. A.**, Mechanical Engineer, The Bell Telephone Company of Pennsylvania, and for mail, 6017 Pine Street, Philadelphia, Pennsylvania.
- SHOBER, SAMUEL L.**, Special Representative, Union Switch and Signal Company, and for mail, Rittenhouse Club, 1811 Walnut Street, Philadelphia, Pa.
- SHOEMAKER, SAMUEL**, Builder and Real Estate, 1132 Land Title Building, Philadelphia, Pennsylvania.
- SHOEMAKER, THOMAS H.**, (Retired), 120 West Tulpehocken Street, Germantown, Philadelphia, Pennsylvania.
- SILLCOX, LEWIS K.**, Mechanical and Electrical Engineer, Herrick Road, Box 579, Riverside, Illinois.
- SIMS, Rear Admiral WILLIAM S.**, U.S.N., General Board Naval War College, Newport, Rhode Island.
- SIMSOHN, JULIAN STERN**, Chemist, S. E. corner Broad Street and Girard Avenue, Philadelphia, Pennsylvania.
- SINKLER, JOHN P. B.**, Architect, 412 Otis Building, 112 South 16th Street, Philadelphia, Pennsylvania.
- SKINNER, C. E.**, Engineer, Research Division, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania.
- SKINNER, H. J.**, Vice-President, Arthur D. Little, Incorporated, 71 West Chestnut Street, Wakefield, Massachusetts.
- SKINNER, ORVILLE CAMPBELL**, Metallurgical Engineer, Superintendent, Standard Steel Works, Burnham, Pennsylvania.
- SLATER, HOWARD C.**, Mechanical Engineer, Ridley Park, Pennsylvania.
- SMALLING, ELMER, JR.**, Student, 2939 North Camac Street, Philadelphia, Pennsylvania.
- SMITH, A. D. W.**, Mining Engineer, Coal Exchange Building, Wilkes-Barre, Pennsylvania.
- SMITH, ALBERT W.**, Professor of Industrial Chemistry, Case School of Applied Science, and for mail, 11333 Bellflower Road, Cleveland, Ohio.
- SMITH, A. T.**, in care of The Permutit Company, 440 Fourth Avenue, New York City, New York.
- SMITH, AUGUSTUS**, Civil Engineer, Elizabeth, R. F. D. No. 2, New Jersey.
- SMITH, EDWARD W.**, Chemical Engineer, 735 East Penn Street, Germantown, Philadelphia, Pennsylvania.
- SMITH, FRANK W.**, Vice President and General Manager, The United Electric Light and Power Company, 130 East 15th Street, New York City, New York.
- SMITH, HASELTINE**, Insurance Broker, 326 Walnut Street, Philadelphia, Pennsylvania.
- SMITH, HERBERT, S. S.**, Professor of Civil Engineering, 205 Wallace Street, Stroudsburg, Pennsylvania.
- SMITH, IRVING B.**, Chief of Research Department, Leeds and Northrup Company, and for mail, Ambler, Pennsylvania.

- SMITH, J. WALDO**, Chief Engineer, Board of Water Supply, City of New York, Municipal Building, New York City, New York.
- SMITH, Dr. LESLIE DENIS**, 406 Rutland Courts, 1725 17th Street, N. W., Washington, D. C.
- SMITH, N. W.**, Pennsylvania Railroad Company, Room 372, Broad Street Station, Philadelphia, Pennsylvania.
- SMITH, OBERLIN**, Mechanical Engineer and Manufacturer, in care of Ferracute Machine Company, Bridgeton, New Jersey.
- SMITH, P. F., JR.**, Manager, Altoona Works, Pennsylvania System, Altoona, Pennsylvania.
- SMITH, S. D.**, Machinist, 1616 North Redfield Street, Philadelphia, Pennsylvania.
- SMITH, WALTER B.**, Builder, 6490 Woodbine Avenue, Overbrook, Philadelphia, Pennsylvania.
- SMITH, W. HINCKLE**, Banker, Bryn Mawr, Pennsylvania.
- SMITH, W. LEIGH**, Chemist, The Viscose Company, Box 171, Marcus Hook, Pennsylvania.
- SNELLENBERG, SAMUEL**, Merchant, Market and Twelfth Streets, Philadelphia, Pennsylvania.
- SNELLING, WALTER O.**, Research Chemist, 208 North 5th Street, Allentown, Pennsylvania.
- SNOOK, H. CLYDE**, Electrical Engineer, c/o Western Electric Company, 463 West Street, New York City, New York.
- SNYDER, CLINTON F.**, Chemist, Minersville, Pennsylvania.
- SNYDER, Professor MONROE B.**, Teacher and Astronomer, 111 Grand View Road, Ardmore, Pennsylvania.
- SOULAS, CHARLES W.**, Hotel Proprietor, 2022 N. Park Avenue, Philadelphia, Pennsylvania.
- SOUTHALL, JAMES P. C.**, Associate Professor of Physics, Columbia University, New York City, New York.
- SPACKMAN, H. S.**, President, Henry S. Spackman Engineering Company, 2024 Arch Street, Philadelphia, Pennsylvania.
- SPENCER, H. B.**, President, Fruit Growers' Express Company, Munsey Building, Washington, D. C.
- SPENCER, PAUL**, Electrical Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- SPENCER, THOMAS**, Engineer, 3523 Balsam Avenue, Indianapolis, Indiana.
- SPERR, F. W., Jr.**, Chief Chemist, The H. Koppers Company, Laboratory, Mellon Institute, Pittsburgh, Pennsylvania.
- SPERRY, ELMER A.**, Engineer, The Sperry Gyroscope Company, Sperry Building, Manhattan Bridge Plaza, Brooklyn, New York.
- SPICER, H. N.**, Metallurgical Engineer, The Architects Building, 101 Park Avenue, New York City, New York.
- SPITZ, SAMUEL**, Inventor, 372 Bellevue Avenue, Oakland, California.
- SPITZGLASS, J. M.**, Mechanical Engineer, 2240 Diversey Boulevard, Chicago, Illinois.
- SPRAGUE, FRANK J.**, Consulting Engineer, President, Sprague Safety Control & Signal Corporation, 421 Canal Street, New York City, New York.
- SPRONG, S. D.**, Electrical Engineer, Atlantic Utilities Corporation, 2 Rector Street, New York City, New York.
- SPRUANCE, W. C.**, Vice President, in Charge of Production Department, E. I. du Pont de Nemours and Company, and for mail, 2507 West 17th Street, Wilmington, Delaware.
- SQUIER, GEORGE OWEN**, Major General, Chief Signal Officer, U. S. Army, K. C. M. G., D. S. C., War Department, Washington, D. C.
- STANFORD, H. R.**, Captain Civil Engineer, (C.E.C.), U.S.N., Naval Operating Base, Hampton Roads, Norfolk, Virginia.
- STANLEY, FRANK A.**, Editor, East Auburn, California.
- STEEL, JOSEPH M.**, Building Constructor, 1600 Arch Street, Philadelphia, Pennsylvania.
- STEIN, A.**, Manufacturer, 97 Gold Street, New York City, New York.
- STEINMETZ, Dr. CHARLES P.**, Chief Consulting Engineer, General Electric Company, and Professor of Electro-Physics, Union College, and for mail, Wendell Avenue, Schenectady, New York.
- STEINMETZ, JOSEPH ALLISON**, Designer, Janney, Steinmetz and Company, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- STEINMETZ, SPENCER J.**, 31 Evans Road, Brookline, Massachusetts.
- STUBER, HENRY J.**, Chemist, 509 South 10th Street, Philadelphia, Pennsylvania.
- STEVENS, F. S.**, Engineer Maintenance of Way, Philadelphia and Reading Railway Company, and for mail, 540 North 5th Street, Reading, Pennsylvania.
- STEVENS, JOHN S.**, 9th Street and Montgomery Avenue, Philadelphia, Pennsylvania.
- STEVENSON, Dr. A. R., Jr.**, Electrical Engineer, General Electric Company, 6 Union Street, Schenectady, New York.

- STEVENSON, S. PRICE**, Manufacturer of Cold Storage Doors, 1500 West 4th Street, Chester Pennsylvania.
- STEWART, FRANK H.**, Dealer in Electrical Supplies, Old Mint Building, Philadelphia, Pennsylvania.
- STEWART, FRANK H.**, Address unknown.
- STEWART, RALPH C.**, Attorney-at-Law, 803 West End Trust Building, Philadelphia, Pennsylvania.
- STEWART, THOMAS S.**, Physician, 18th and Spruce Streets, Philadelphia, Pennsylvania.
- STILLWELL, L. B.**, Consulting Engineer, 143 Liberty Street, New York City, New York.
- STINE, WILBUR M.**, Author, 3932 Haverford Avenue, Philadelphia, Pennsylvania.
- STITZER, A. B.**, Chief Engineer, Republic Engineers, Incorporated, 60 Broadway, New York City, New York.
- STOERTZ, HOWARD**, Research Chemist, Electric Storage Battery Company, and for mail, 4741 Rosehill Street, Philadelphia, Pennsylvania.
- STOKES, FRANCIS J.**, Machinery Manufacturer, 17th and Cambria Streets, Philadelphia, Pennsylvania.
- STOKLEY, JAMES JR.**, Student, 4531 Osage Avenue, Philadelphia, Pennsylvania.
- STONE, C. W.**, Electrical Engineer, General Electric Company, Schenectady, New York.
- STONE, JOHN STONE**, Consulting Electrical Engineer, 4811 Panorama Street, San Diego, Cal.
- STOTESBURY, E. T.**, Banker, Chestnut and Fifth Streets, Philadelphia, Pennsylvania.
- STOUGHTON, A. B.**, Attorney-at-Law, 1506 Land Title Building, Philadelphia, Pennsylvania.
- STOUT, ORIN C.**, Hydraulic and Sanitary Engineer, 207 Commerce Building, Columbus, Ohio.
- STRADLING, Dr. G. F.**, Teacher, Principal Northeast High School, and for mail, 5120 Newhall Street, Germantown, Philadelphia, Pennsylvania.
- STRONG, WILLIAM WALKER**, Consulting Physicist, 500 South York Street, Mechanicsburg, Cumberland County, Pennsylvania.
- STROUD, EDWARD A.**, Florist, 508 South 41st Street, Philadelphia, Pennsylvania.
- STUTZ, ERNEST**, Representative for Foreign Patents, 1705 Hope Street, South Pasadena, California.
- STYRI, Dr. HAAKON**, Chief Chemist, S. H. F. Research Laboratory, Front Street & Erie Avenue, Philadelphia, Pennsylvania.
- SUCZEK, ROBERT**, Mechanical Engineer, C. H. Wheeler Manufacturing Company, 18th Street and Lehigh Avenue, Philadelphia, Pennsylvania.
- SULZNER, CHARLES F.**, (Retired), 236 S. W. 2nd Street, Miami, Florida.
- SUPPLEE, WM. H.**, Factory Manager, 211 South 12th Street, Philadelphia, Pennsylvania.
- SUTTON, FRANK W.**, Industrial Engineer, Charles E. Bedaux Company, 4500 Euclid Avenue, Cleveland, Ohio.
- SWEET, H. N.**, Banker, 63 Mt. Vernon Street, Boston, Massachusetts.
- SWENSON, MAGNUS**, President and Treasurer, Southern Wisconsin Power Company, Madison, Wisconsin.
- SYKES, JOHN P.**, The Baldwin Locomotive Works, Broad and Spring Garden Streets, Philadelphia, Pennsylvania.
- SYMONS, JOHN E.**, Mechanical Engineer, The Texas Company, 17 Battery Place, New York City, New York.
- SYMONS, WILSON E.**, Consulting Engineer, 108 West 43rd Street, New York City, New York.
- SYNNESTVEDT, ARTHUR**, Student, Bryn Anthyn, Pennsylvania.
- TABER, GEORGE H.**, Vice President, Gulf Refining Company, P. O. Box 1214, Pittsburgh, Pennsylvania.
- TAGGART, WALTER T.**, Professor of Chemistry, University of Pennsylvania, Philadelphia, Pennsylvania.
- TAIT, EDWARD H.**, Superintendent, 401 Brighter Apartments, Second & Penn Streets, Reading, Pennsylvania.
- TAIT, F. M.**, 80 Broadway, New York City, New York.
- TAKAMINE, JOKICHI**, Research Chemist, Equitable Building, New York City, New York.
- TALBOT, H. P.**, Professor of Inorganic Chemistry, Massachusetts Institute of Technology, Boston, Massachusetts.
- TANBERG, Dr. ARTHUR F.**, Chemist, E. I. du Pont de Nemours & Company, Henry Clay, Delaware.
- TATE, ALFRED O.**, President, Tate Electrolytic Textile Processes, Incorporated, Cranston, Rhode Island.
- TATNALL, Dr. ROBERT R.**, Research Engineer, J. E. Rhoads and Sons, Wilmington, Delaware.
- TAWS, LOUIS**, (Retired), 6654 Lincoln Drive, Germantown, Philadelphia, Pennsylvania.
- TAYLOR, DAVID WATSON**, Rear Admiral, Chief, Bureau of Construction and Repair, Navy Department, Washington, D. C.
- TAYLOR, EDWARD B.**, Vice President, Pennsylvania Lines West of Pittsburgh, 901 Pennsylvania Station, Pittsburgh, Pennsylvania.

- TAYLOR, HOLLINSHEAD N.**, Tinplate Manufacturer, 300 Chestnut Street, Philadelphia, Pennsylvania.
- TAYLOR, LOWNDES**, Address unknown.
- TEEPLE, Dr. JOHN E.**, Consulting Chemist and Chemical Engineer, 50 East 41st Street, New York City, New York.
- TEMPLE, EDWARD B.**, Swarthmore, Pennsylvania.
- THAMM, CHARLES G. A.**, Clerk, 847 Levick Street, Lawndale, Philadelphia, Pennsylvania.
- THOMAS, ARTHUR H.**, Laboratory Appliances, West Washington Square, Philadelphia, Pennsylvania.
- THOMAS, C. C.**, Professor of Mechanical Engineering, Dwight P. Robinson and Company, Electric Equipment Building, 1240 South Hope Street, Los Angeles, California.
- THOMAS, L. E.**, President, Reading Iron Company, Reading, Pennsylvania.
- THOMPSON, ARTHUR W.**, President, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.
- THOMPSON, HUGH L.**, Consulting Engineer, Waterbury, Connecticut.
- THOMPSON, PAUL, N. W.** cor. Broad and Arch Streets, Philadelphia, Pennsylvania.
- THOMPSON, ELIHU**, Professor, Electrical Engineer, 22 Monument Avenue, Swampscott, Massachusetts.
- THOMSON, Sir JOSEPH J.**, Trinity College, Cambridge, England.
- THORNE, WILLIAM H.**, Mechanical Engineer, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- TIDDY, WILLIAM**, Chief Chemist, Rainey-Wood Coke Company, Swedeland, Pennsylvania.
- TIEMANN, HUGH P.**, Metallurgical Engineer, Carnegie Steel Company, Pittsburgh, Pennsylvania.
- TIERNEY, L. E.**, Coal Operator, Powhatan, West Virginia.
- TIGERSTEDT, A. F.**, General Director, Board of Trade, Helsingfors, Finland.
- TILGHMAN, B. C.**, Manufacturer, Highfield, Dunham Road, Altrincham, Cheshire, England.
- TITZEL, R. JOHN**, Gas Engineer, Hamilton Apartments, Norristown, Pennsylvania.
- TOCH, MAXIMILIAN**, Paint Manufacturer, Director, Research Laboratory, Toch Brothers, 320 Fifth Avenue, New York City, New York.
- TORCHIO, PHILIP**, Chief Electrical Engineer, The New York Edison Company, Irving Place and 15th Street, New York City, New York.
- TOULMIN, H. A., JR.**, Patent Attorney, 901 Schwind Building, Dayton, Ohio.
- TOWNE, HENRY R.**, Mechanical Engineer, 420 Park Avenue, New York City, New York.
- TOWNEND, R. V.**, Research Chemist, Victor Talking Machine Company, Camden, New Jersey.
- TOWNSEND, JOHN SEALY**, Professor of Physics, New College, Oxford, England.
- TOWNSEND, J. W.**, 825 Montgomery Avenue, Bryn Mawr, Pennsylvania.
- TRAUTWINE, JOHN C., JR.**, Civil Engineer, 257 South 4th Street, Philadelphia, Pennsylvania.
- TRAUTWINE, JOHN C., 3rd.**, Civil Engineer, Box 6509, Upper Darby Branch, Philadelphia, Pennsylvania.
- TREXLER, HARRY C.**, Colonel, President, Lehigh Portland Cement Company, Allentown, Pennsylvania.
- TROWBRIDGE, Professor AUGUSTUS**, Teacher, Princeton University, Princeton, New Jersey.
- TRUEMAN, WILLIAM H.**, Dentist, 47 High Street, Germantown, Philadelphia, Pennsylvania.
- TSCHUDY, EARL H.**, Teacher in High School, 138 South 4th Street, Lebanon, Pennsylvania.
- TURNER, WILLIAM JAY**, Attorney-at-Law, Lycoming, School House Lane, Germantown, Philadelphia, Pennsylvania.
- TUTTLE, E. B.**, Engineer of Transmission and Protection, Bell Telephone Company of Pennsylvania, 261 North Broad Street, Philadelphia, Pennsylvania.
- TUTWILER, C. C.**, Consulting Gas Chemist, West Conshohocken, Pennsylvania.
- TWING, WM. STANTON**, Civil Engineer, 119 Harvey Street, Germantown, Philadelphia, Pennsylvania.
- TYSON, H. P.**, Collegeville, Pennsylvania.
- UEHLING, E. A.**, Mechanical Engineer, 3226 McKinley Building, Milwaukee, Wisconsin.
- ULMER, CARL D.**, Chemist, Minnesota By-Product Coke Company, 1000 Hamline Avenue, St. Paul, Minnesota.
- UNDERWOOD, FREDERICK D.**, President, Erie Railroad Company, 50 Church Street, New York City, New York.
- UNWIN, WILLIAM CAWTHORNE**, Civil Engineer, Palace Gate Mansions, Kensington, London, England.
- VAIL, JAMES G.**, Chief Chemist, Philadelphia Quartz Company, 121 South 3rd Street, Philadelphia, Pennsylvania.
- VALASEK, J.**, Physicist, 898 18th Avenue, S. E., Minneapolis, Minnesota.

- VAN DER LINGEN, J. STEPHEN**, Lecturer, Department of Applied Mathematics, University of Cape Town, Cape Town, South Africa.
- VAN DEVENTER, CHRISTOPHER**, Consulting Engineer, 438 First National Bank Building, Chicago, Illinois.
- VAN DEVENTER, H. R.**, Engineer and Patent Attorney, Bureau Patent Development, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania.
- VAN DYKE, J. W.**, President, The Atlantic Refining Company, and for mail, The Wellington, Philadelphia, Pennsylvania.
- VAN TRUMP, S. N.**, Civil Engineer, Water Department, Wilmington, Delaware.
- VAUCLAIN, S. M.**, President, The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- VAUGHAN, H. H.**, Engineer, 20 MacGregor Street, Montreal, Quebec, Canada.
- VAUGHEN, F. G.**, Manager, Meter Department, General Electric Company, Schenectady, New York.
- VAUX, GEORGE, JR.**, Attorney-at-Law, Gulf Road, Bryn Mawr, Pennsylvania.
- VEEDER, CURTIS H.**, Manufacturer, Veeder Manufacturing Company, Hartford, Connecticut.
- VIAL, ETHAN**, 7474 Lower River Road, Fernbank, Cincinnati, Ohio.
- VOGLESON, JOHN A.**, Civil Engineer, 8009 Crefeldt Street, Philadelphia, Pennsylvania.
- VREELAND, FREDERICK R.**, Research Engineer, 90 West Street, New York City, New York.
- WADDELL, J. A. L.**, Consulting Engineer, 35 Nassau Street, New York City, New York.
- WADLEIGH, F. R.**, Fuel Division, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.
- WADSWORTH, F. L. O.**, Consulting and Advisory Engineer, P. O. Box 268, East Liberty Station, Pittsburgh, Pennsylvania.
- WAGNER, FRED H.**, Chief Engineer, The Bartlett Hayward Company, and for mail, Lombardy Apartments, 39th Street and Stony Run Lane, Baltimore, Maryland.
- WAGNER, HERBERT A.**, President, Consolidated Gas Electric Light and Power Company, Lexington and Liberty Streets, Baltimore, Maryland.
- WAGNER, SAMUEL T.**, Chief Engineer, Philadelphia and Reading Railway Company, and for mail, School House Lane, Germantown, Philadelphia, Pennsylvania.
- WALDRON, WILLIAM H.**, Manufacturer of Machinery, John Waldron Company, New Brunswick, New Jersey.
- WALKER, J. W.**, Manufacturer, Address unknown.
- WALLER, ALFRED E.**, Electrical Engineer, Lawrence Park, Bronxville, New York.
- WALLERSTEIN, LEO**, Chemist, 171 Madison Avenue, New York City, New York.
- WALLIS, J. T.**, Chief of Motive Power, Pennsylvania System, Broad Street Station, Philadelphia, Pennsylvania.
- WALTON, HORACE**, Insurance, 416-420 Walnut Street, Philadelphia, Pennsylvania.
- WANAMAKER, JOHN**, Merchant, 1300 Market Street, Philadelphia, Pennsylvania.
- WARD, ALGER L.**, Chemist, 1962 Spencer Street, Philadelphia, Pennsylvania.
- WARDEN, WILLIAM G.**, 1012 Witherspoon Building, Philadelphia, Pennsylvania.
- WARNER, WM. R., JR.**, (Retired), Duffryn Mawr, Chester County, Pennsylvania.
- WARNOCK, JAMES, JR.**, Bookkeeper, 333 Chestnut Street, Philadelphia, Pennsylvania.
- WARRINER, S. D.**, President, Lehigh Coal and Navigation Company, 437 Chestnut Street, Philadelphia, Pennsylvania.
- WARWICK, J. F.**, Electrical Engineer, 61 Crew Street, Atlanta, Georgia.
- WATSON, JAMES**, Steam Specialty Manufacturer, 146 North Seventh Street, Philadelphia, Pennsylvania.
- WEBSTER, ALBERT L.**, Consulting Sanitary Engineer, 112 E. 40th Street, New York City, New York.
- WEBSTER, GEORGE S.**, Civil Engineer, 4900 Penn Street, Frankford, Philadelphia, Pennsylvania.
- WEBSTER, WM. R.**, Consulting and Inspecting Engineer, 413 Walnut Street, Philadelphia, Pennsylvania.
- WEDGE, UTLEY**, Engineer, Sulphuric Acid Expert, Ardmore, Pennsylvania.
- WEEKS, EDWIN R.**, Consulting Engineer, 604-6 New Nelson Building, Kansas City, Missouri.
- WEIDLEIN, EDWARD R.**, Chemical Engineer, Director of Mellon Institute of Industrial Research, Pittsburgh, Pennsylvania.
- WEINBERG, SOLOMON**, Chemical Engineer, Sunderland House, 35th Street and Powelton Avenue, Philadelphia, Pennsylvania.
- WEISS, J. M.**, Manager, Research Department, The Barrett Company, 40 Rector Street, New York City, New York.
- WELLS, G. A.**, 11 West 8th Street, New York City, New York.

- WELLS, W. F., Vice President, Edison Electric Illuminating Company, 360 Pearl Street, Brooklyn, New York.
- WELSH, FRANCIS RALSTON, Investments, Devon, Pennsylvania.
- WELTZ, EARL H., Chemist, E. I. du Pont de Nemours & Company, 122 Broadway, Carney's Point, New Jersey.
- WESTON, Dr. EDWARD, President, Weston Electrical Instrument Company, Waverly Park, Newark, New Jersey.
- WESTON, F. W., Manufacturer, Wynnewood, Pennsylvania.
- WETHERILL, ROBERT, Engine and Machine Work Manufacturer, Chester, Pennsylvania.
- WETHERILL, S. P., Manufacturer, Room 600, Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- WETHERILL, W. CHATTIN, Department of Mechanical Engineering, University of Pennsylvania, Philadelphia, Pennsylvania.
- WEYL, CHARLES N., 6506 Lincoln Drive, Germantown, Philadelphia, Pennsylvania.
- WHARTON, HENRY, Chestnut Hill, Philadelphia, Pennsylvania.
- WHITAKER, JAMES L., Cotton Manufacturer, Cedar Grove, Olney, Philadelphia, Pennsylvania.
- WHITE, J. ATWOOD, Paper Machinery Manufacturer, 15th Street and Lehigh Avenue, Philadelphia, Pennsylvania.
- WHITE, W. M., Hydraulic Engineer, Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin.
- WHITNEY, ASA W., Metallurgist, in care of Enterprise Foundry and Machine Works, Bristol, Tennessee.
- WHITNEY, CHARLES H., Whitney-MacDonald Company, Tioga and Memphis Streets, Philadelphia, Pennsylvania.
- WHITNEY, E. R., President, Commercial Truck Company, Hunting Park and Rising Sun Avenue, Philadelphia, Pennsylvania.
- WHITNEY, FRANK E., Mechanical Engineer, Commercial Truck Company, Hunting Park and Rising Sun Avenues, Philadelphia, Pennsylvania.
- WHITNEY, LOUIS B., Manager, Alpha Portland Cement Company, 428 Oliver Building, Pittsburgh, Pennsylvania.
- WHYTE, F. M., Vice President, Hutchins Car Roofing Company, New York City, and for mail, 14 Benedict Avenue, Tarrytown, New York.
- WIDDICOMBE, Major R. A., Engineer, 4639 Beacon Street, Chicago, Illinois.
- WIEDERSHEIM, J. A., Patent Attorney and Mechanical Expert, 1232 Chestnut Street, Philadelphia, Pennsylvania.
- WIEGAND, JOHN, Salesman, 2020 North Marshall Street, Philadelphia, Pennsylvania.
- WILBUR, W. A., Banker, South Bethlehem, Pennsylvania.
- WILEY, Dr. H. W., Chemist, Room 1120, Woodward Building, Washington, D. C.
- WILKIN, JOHN T., President and Engineer, The Connersville Blower Company, and for mail, 905 Grand Avenue, Connersville, Indiana.
- WILLCOX, JAMES M., Wawa, Delaware County, Pennsylvania.
- WILLCOX, W. F., Darling Post Office, Delaware County, Pennsylvania.
- WILLE, H. V., Assistant, Vice President, The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- WILLIAMS, E. D., Attorney-at-Law, 560 Drexel Building, Philadelphia, Pennsylvania.
- WILLIAMS, HENRY S., President, Williams, Brown and Earle, Incorporated, 918 Chestnut Street, Philadelphia, Pennsylvania.
- WILLIAMS, IRA JEWELL, Attorney-at-Law, 1005 Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- WILLIAMS, Dr. WILLIAM J., Chemist, 1503 Foulkrod Street, Frankford, Philadelphia, Pennsylvania.
- WILLIAMSON, J. D., JR., Vice President, American Engineering Company, Latham Park, Oak Lane P. O., Philadelphia, Pennsylvania.
- WILSON, ARTHUR M., General Insurance, 706 Stock Exchange Building, Philadelphia, Pennsylvania.
- WILSON, DAVID H., Student, 640 North 32nd Street, Philadelphia, Pennsylvania.
- WILSON, H. A., Coronado Apartments, 22nd and Chestnut Streets, Philadelphia, Pennsylvania.
- WILSON, H. D., Coronado Apartments, 22nd and Chestnut Streets, Philadelphia, Pennsylvania.
- WILSON, HENRY W., Civil Engineer, 909 Clinton Street, Philadelphia, Pennsylvania.

- WILSON, J., CLIFFORD, President and Treasurer, J. S. Wilson and Son, Incorporated, Room 205, 1509 Arch Street, Philadelphia, Pennsylvania.
- WILSON, J. HUNT, Professor of Chemistry, Lafayette College, 531 Cattell Street, Easton, Pennsylvania.
- WILSON, J. L., 608 Chestnut Street, Philadelphia, Pennsylvania.
- WILSON, JOHN S., Inspector, 124 South Eutaw Street, Baltimore, Maryland.
- WIRT, CHARLES, President and Engineer, Wirt Company, and for mail, 508 East Washington Lane, Germantown, Philadelphia, Pennsylvania.
- WOLF, JOHN JACOB, 927 North Fifth Street, Philadelphia, Pennsylvania.
- WOOD, ALAN, 3rd, Mechanical Engineer, Flat Rock, North Carolina.
- WOOD, ALBERT C., Consulting Mechanical Engineer, Stock Exchange Building, Philadelphia, Pennsylvania.
- WOOD, BIDDLE, Iron Manufacturer, Conshohocken, Pennsylvania.
- WOOD, E. R., JR., Mechanical Engineer, 409 Chestnut Street, Philadelphia, Pennsylvania.
- WOOD, F. W., President, Maryland Steel Company, and for mail, Keyworth Avenue, Baltimore, Maryland.
- WOOD, ROBERT L., Civil Engineer, Cruse-Kemper Company, Main Street, Ambler, Pennsylvania.
- WOOD, WALTER, Manufacturer, 400 Chestnut Street, Philadelphia, Pennsylvania.
- WOODBIDGE, J. LESTER, Electrical Engineer, 19th Street and Allegheny Avenue, Philadelphia, Pennsylvania.
- WOODBURY, C. A., Director, Eastern Laboratory, E. I. du Pont de Nemours Company, Drawer 424, Chester, Pennsylvania.
- WOODHOUSE, HENRY, Editor, Foster Building, Madison Avenue and 40th Street, New York City, New York.
- WOODROFFE, G. H., Mechanical and Metallurgical Engineer, Parkesburg, Chester County, Pennsylvania.
- WOODWARD, GEORGE, Physician, 708 North American Building, Philadelphia, Pennsylvania.
- WOOLMAN, EDWARD, Mechanical Engineer, N. W. cor. Buck and Panmure Roads, Haverford, Pennsylvania.
- WORRELL, HOWARD SELLERS, Engineer, 100 East Montgomery Avenue, Ardmore, Pennsylvania.
- WRIGHT, FRANK L., Factory Metallurgist, Atlas Ball Company, 4th Street and Glenwood Avenue, Philadelphia, Pennsylvania.
- WRIGHT, JAMES A., Wright-Fisher Engineering Company, 600 McGill Building, Montreal, Quebec, Canada.
- WRIGHT, ORVILLE, Aeronautical Research Engineer, 15 North Broadway, Dayton, Ohio.
- WRIGHT, ROY V., Editor, 398 North Walnut Street, East Orange, New Jersey.
- WRIGHT, WINTHROP R., Professor of Physics, Swarthmore College, and for mail, 4 Whittier Place, Swarthmore, Pennsylvania.
- WYATT, JAMES H., Electrical Engineer, Cutter Electric and Manufacturing Company, 19th and Hamilton Streets, Philadelphia, Pennsylvania.
- YARNALL, D. ROBERT, Mechanical Engineer, Chestnut Hill, Philadelphia, Pennsylvania.
- YEOMANS, LUCIEN L., Industrial Engineer, Vice President, Amalgamated Machinery Corporation, 1327-53 West Jackson Street, Chicago, Illinois.
- YORK, H. W., Consulting Engineer, 120 Broadway, New York City, New York.
- YORKE, GEORGE M., Engineer, 70 Irving Place, New York City, New York.
- YOUNG, J. BERTRAM, Chemist, Philadelphia and Reading Railway Company, Reading, Pennsylvania.
- ZEHNDER, CHARLES H., Coal and Iron Merchant, Room 1648, 120 Broadway, New York City, New York.
- ZILEN, VICTOR W., Mechanical Engineer, Route No. 1, Box 139, Chattanooga, Tennessee.
- ZIMMERMANN, JOHN E., Mechanical Engineer, Member of Firm, Day and Zimmermann, 611 Chestnut Street, Philadelphia, Pennsylvania.

MEMBERS WHOSE ADDRESSES ARE UNKNOWN.

- ANDERSON, GEORGE L. (Honorary)
- BYRD, JOHN
- HALE, HENRY S.
- PEMBERTON, HENRY R.
- RUMFORD, WILLIAM C.
- STEWART, FRANK H.
- TAYLOR, LOWNDES
- WALKER, J. W.

Important New Scientific Publications

| | |
|--|----------------|
| PETROLEUM By SIR BOVERTON REDWOOD, Bart. New Edition. Revised and Reset. Just Published. In Three Volumes with Plates, Numerous Illustrations in the Text and many New Maps Especially Prepared for this Edition. 1353 Pages. | \$39.00 |
| INDUSTRIAL ORGANIC CHEMISTRY By SAMUEL P. SADTLER, Ph.D., LL.D. and LOUIS J. MATOS, Ph.D. Fifth Edition. Revised, and largely rewritten. Since the publication of the first edition, this has been the standard handbook for the use of manufacturers, chemists and all interested in the utilization of organic materials in the industrial arts. | |
| AUTOMATIC PUMPING By W. WALKER FYFE. Numerous Illustrations, Diagrams and Tables with Notes on Water Analysis and Filtration. Just Published. | 3.00 |
| A TEXT-BOOK OF INORGANIC CHEMISTRY Volume IX, Part Two. Iron. By J. NEWTON FRIEND, D.Sc., Ph.D., F.I.C. Frontispiece and 8 Illustrations. | 7.50 |
| ELEMENTARY TEXT-BOOK OF METALLURGY By A. H. SEXTON, F.I.C. New Edition. Revised and Greatly Enlarged. 70 Illustrations. | 3.50 |
| COKE-OVEN AND BY-PRODUCT WORKS CHEMISTRY By THOMAS BIDDULPH-SMITH. 62 Illustrations and 7 Folding Plates. 196 Pages. | 7.00 |
| SOME MICROCHEMICAL TESTS FOR ALKALOIDS By CHARLES H. STEPHENSON. Illustrated with 27 Plates including 162 Photomicrographs of Tests. | 4.00 |
| RECOVERY OF NITRATE FROM CHILEAN CALICHE By A. W. ALLEN, M.A. | 2.00 |
| ANIMAL AND VEGETABLE FIXED OILS, FATS, BUTTERS AND WAXES By C. R. ADLER WRIGHT, 3 Plates and 185 Illustrations. New Edition, Revised and Enlarged. | 16.50 |
| THE CLAYWORKER'S HANDBOOK By ALFRED B. SEARLE. 32 Illustrations. New Edition. Revised and Rewritten. | 6.50 |
| CYANIDING GOLD AND SILVER ORES By H. F. JULIAN and EDGAR SMART. Numerous Illustrations, Plates and Maps. New Edition.* Revised. | 12.50 |
| RUNNING AND MAINTENANCE OF THE MARINE DIESEL ENGINE By JOHN LAMB. Frontispiece, Plates and 106 Illustrations. New Edition. Revised. | 3.00 |
| QUESTIONS AND ANSWERS RELATING TO DIESEL, SEMI-DIESEL AND OTHER INTERNAL COMBUSTION ENGINES, AIR COMPRESSORS, ETC. By JOHN LAMB. | 2.50 |
| OIL FUEL By EDWARD BUTLER. Numerous Illustrations. New Edition. Revised and Enlarged. | 5.00 |
| PETROLEUM REFINING By ANDREW CAMPBELL. Illustrated. New Edition, Revised. | 8.50 |

J. B. LIPPINCOTT COMPANY PUBLISHERS
PHILADELPHIA

FIDELITY TRUST COMPANY

325 Chestnut St.
1431 Chestnut St.

6324 Woodland Ave.
West Philadelphia



Directors

Henry W. Biddle . . . Thomas A. Biddle & Co., Bankers
William P. Gest . . . President
Edward Walter Clark . E. W. Clark & Co., Bankers
John S. Jenks, Jr. . . . Banker
Charlemagne Tower . . Attorney at Law
Edward T. Stotesbury . Drexel & Co., Bankers
Morris R. Bockius . . . Morgan, Lewis & Bockius, Attorneys
G. Colesberry Purves . . President, Philadelphia Saving Fund
Society
Samuel T. Bodine . . . President, United Gas Improvement Co.
Jonathan C. Neff . . . Vice-President
Sidney F. Tyler Chairman Board, Fourth Street National
Bank
Daniel B. Wentz . . . President, J. S. Wentz Co.
Joseph E. Widener . . . Financier
Thomas D. M. Cardeza . . . Banker

Capital
\$5,200,000

Surplus
\$16,000,000

Funds Held
in Trust
More Than
\$290,000,000

JOURNAL OF THE FRANKLIN INSTITUTE

The Institute has for sale a limited number of copies of the earlier issues and is prepared to supply orders at the following rates:

| | |
|---|---|
| 1824 to 1839, inclusive . . . Prices on application | 1880 to 1899, inclusive . . . \$1.00 per number |
| 1840 to 1859, inclusive . . . \$2.00 per number | 1900 to 1909, inclusive75 per number |
| 1860 to 1879, inclusive . . . 1.50 per number | 1910 and later60 per number |

Members may obtain bound volumes of the current issue of the Journal by returning their unbound copies in good condition with \$1.95.

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

PAMPHLET REPRINTS OF LECTURES AND OTHER CONTRIBUTIONS

A limited number of reprints of the various papers which appear in the Journal are now on sale. They may be purchased at twenty-five cents per copy.

Complete pamphlets of articles appearing in two or more instalments will be charged for at the rate of twenty-five cents per issue.

Orders and inquiries should be addressed to

THE FRANKLIN INSTITUTE

PHILADELPHIA

AMERICAN PLATINUM WARE

Standard Ware—Made of our specially refined platinum.
Meets the most exacting demands of the laboratory worker.

Complete Catalogue No. 15 on request

AMERICAN PLATINUM WORKS

NEWARK, N. J.

Welsbach Company

GLOUCESTER, N. J.

Manufacturers of

THORIUM NITRATE

and other rare earth chemicals,
including SALTS of

Cerium Lanthanum Neodymium Yttrium
Zirconium Beryllium Mesothorium Samarium

Welsbach Lights & Mantles

COLORS

Acid—Mordant—Basic—Direct—Sulphur

Intermediates
Hydrosulphites

Sizing Materials
Cotton Finishes

Turkey Red Oils
Soluble Oils

OFFERED BY

H. A. METZ & CO., Inc.

Boston
Philadelphia
Chicago

122 Hudson Street
New York

Charlotte
San Francisco
Providence

THE JOHN T. DYER QUARRY CO.

BUSINESS ESTABLISHED 1891

BIRDSBORO TRAPPE ROCK

HARRISON BUILDING
PHILADELPHIA

ALAN WOOD IRON & STEEL CO.



PHILADELPHIA

FIG IRON

BILLETS, BLOOMS AND SLABS

SHEARED PLATES

ROLLED STEEL FLOOR PLATES

BLUE ANNEALED STEEL SHEETS

ELECTRICAL TESTING LABORATORIES

Electrical and Mechanical Laboratories

Tests of Electrical Machinery, Apparatus and Supplies.
Materials of Construction. Coal, paper, etc. Inspection
of Material and Apparatus at Manufactories.

80th St. and East End Ave.

New York

HENRY BOWER
Chemical Manufacturing Company
YELLOW PRUSSIATES

**SODIUM
CALCIUM**

PHILADELPHIA

PENNSYLVANIA

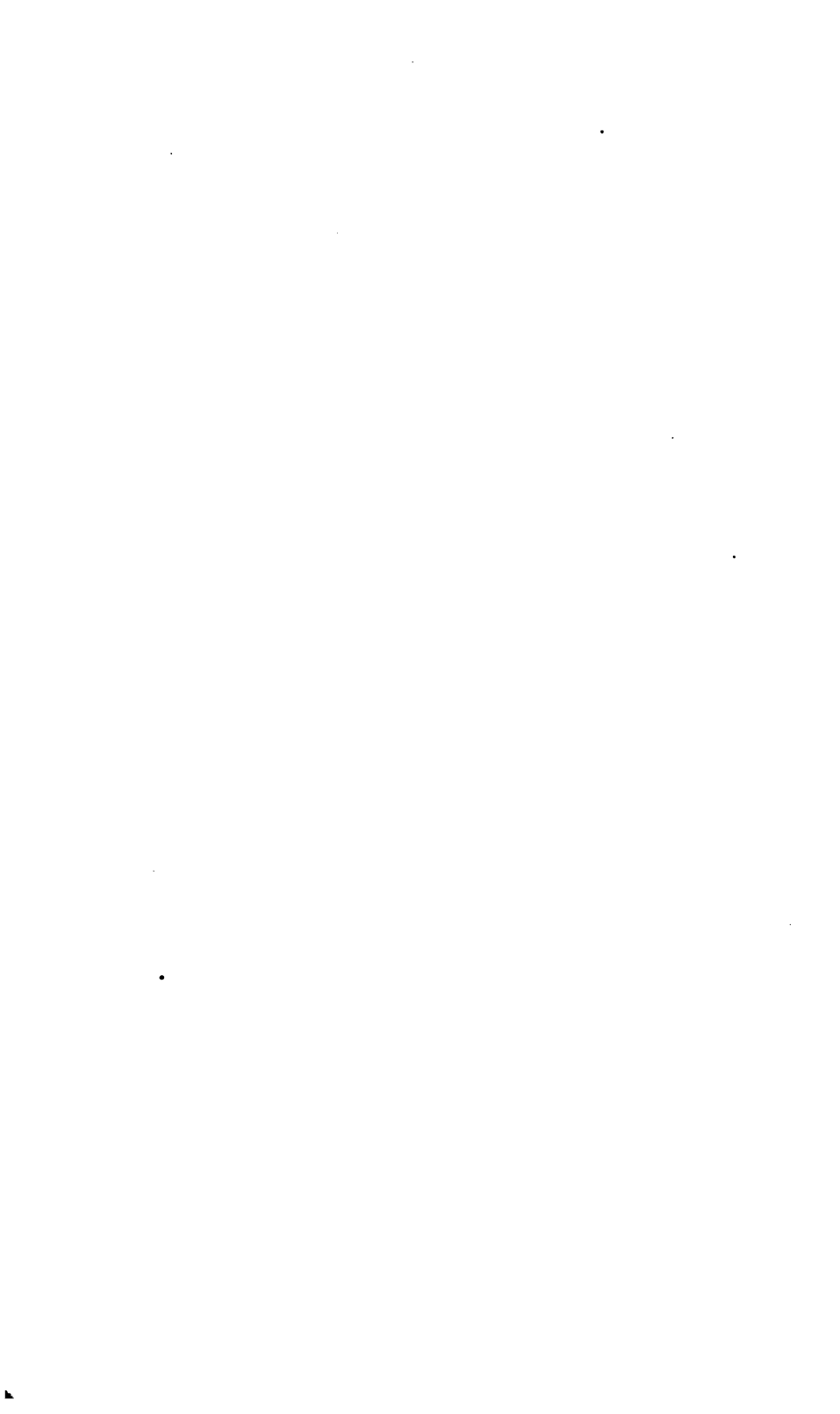
JOHN J. GRIFFIN & CO.

Manufacturers of

GAS METERS
AND APPARATUS

Repairing Promptly Attended to

No. 1513 to 1521 Race Street
PHILADELPHIA







The Franklin Institute

OF THE

STATE OF PENNSYLVANIA



1923 YEAR BOOK

UNIVERSITY OF MICHIGAN LIBRARIES

NOW READY

THE ELECTRON IN CHEMISTRY

BEING FIVE LECTURES DELIVERED AT
THE FRANKLIN INSTITUTE,
PHILADELPHIA

BY

SIR J. J. THOMSON, O.M., F.R.S.

MASTERS OF TRINITY COLLEGE AND PROFESSOR OF EXPERIMENTAL PHYSICS
IN THE UNIVERSITY OF CAMBRIDGE

144 Pages, Illustrations, 8vo.

PRICE \$1.75 (Carriage extra).

Address Orders and Inquiries to
THE FRANKLIN INSTITUTE
PHILADELPHIA, U. S. A.





BENJAMIN FRANKLIN

VENERATED FOR BENEVOLENCE, ADMIRER FOR TALENTS, ESTEEMED
FOR PATRIOTISM, BELOVED FOR PHILANTHROPY.

—(*Washington.*)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

FOUNDED 1824

Year Book---1923

PHILADELPHIA

HALL OF THE INSTITUTE

15 SOUTH SEVENTH STREET

SEPTEMBER 1, 1923

Transportation
Library

T
I
F824 Y
1923

TELEPHONES

Bell, . . . Lombard 6847

Keystone, . . Main 6641

PHYSICS OF THE AIR

BY

W. J. HUMPHREYS, C.E., PH.D.

PROFESSOR OF METEOROLOGICAL PHYSICS, UNITED STATES WEATHER BUREAU,
WASHINGTON, D. C.

665 PAGES, NUMEROUS ILLUSTRATIONS AND DIAGRAMS,
INDEX, OCTAVO. BOUND IN CLOTH

Price, \$5.00

Carriage extra.

Address inquiries and orders to
THE FRANKLIN INSTITUTE
PHILADELPHIA

INTRODUCTION

THE physical phenomena of the earth's atmosphere are exceedingly numerous and of great importance. Nevertheless, the explanations, even of those well understood, still remain scattered through many books and numerous journals. Perhaps this is because some of the phenomena have never been explained, and others but imperfectly so, but, however that may be, it is obvious that an orderly assemblage of all those facts and theories that together might be called the *Physics of the Air* would be exceedingly helpful to the student of atmospheric. An attempt to serve this useful purpose, begun in a course of lectures at the San Diego Aviation School (Rockwell Field) in 1914, led to the production of the following chapters—revised and reprinted from the *Journal of The Franklin Institute*, 1917, 1918, 1919, 1920.

The author begs to express his indebtedness to Prof. C. F. Marvin, Chief of the United States Weather Bureau, for numerous helpful criticisms; to Dr. C. F. Brooks, Editor of the *Monthly Weather Review*, for many excellent suggestions; to Prof. C. F. Talman, Librarian of the United States Weather Bureau, for valuable aid in locating original sources; and to Major R. B. Owens, D. S. O., Secretary of The Franklin Institute, for his encouraging interest in the work and invaluable attention to the details of its publication.

CONTENTS

INTRODUCTION

PART I

Mechanics and Thermodynamics of the Atmosphere, 16 Chapters.

PART II

Atmospheric Electricity and Auroras, 2 Chapters.

PART III

Atmospheric Optics, 8 Chapters.

PART IV

Factors of Climatic Control, 5 Chapters, and Appendices.

INDEX

REVIEWS

"It constitutes a notable addition to the literature of meteorology * * * * There has, up to the present, been no trustworthy English text-book which discussed the subject from so scientific a viewpoint or dealt with its modern developments so completely."

Nature, London, May 23, 1918, page 231.

"The most thorough American work on general meteorology * * * * The purpose of the work is to present a comprehensive, explanatory statement of the physics of the air; one which may form the basis for new courses in meteorology in College and University Departments of Physics * * * * The scope of the book is all that is implied in the title, the physics of the air."

Monthly Weather Review, Washington, D. C., December, 1918, page 562.

"No first-rate comprehensive book on meteorology written from the standpoint of the physicist exists, at present, in any language, and there is perhaps no more striking gap in the literature of science. Dr. Humphreys's book will go a long way toward filling this gap. It is especially remarkable for the amount of skill and labor the author has devoted to checking, verifying—and in many cases discrediting—doctrines and ideas that have heretofore been passed on from one meteorological writer to another without critical examination." *Scientific American*, New York, June 19, 1920, page 669.

"Students of the science of the atmosphere have read with interest and appreciation the articles by Professor W. J. Humphreys of the Weather Bureau of the United States, on various aspects of the physics of the atmosphere which appeared from time to time in the *Journal of The Franklin Institute* of Philadelphia during the years 1917-20. The reproduction of these articles, revised and collected into a book for publication by the Institute, is a notable and welcome event in the history of the study of the air. * * * * The book is fully illustrated with many excellent diagrams and photographs excellently reproduced. * * * * Apart from the general excellence of the book and the presentation of its material, the parts which impress one most on reading them for the first time are the chapters on thunderstorms and lightning, atmospheric electricity and auroras, and atmospheric optics, as examples of close physical reasoning, and the chapters on factors of climatic control as an example of reasoning of a more general character. * * * * He deserves our hearty thanks for a very useful and handy book of reference indispensable for the meteorological library."

Sir Napier Shaw in *Nature*, London, March 17, 1921.

"Bref le livre de M. Humphreys est un ouvrage de synthèse, original en plusieurs de ses parties et en tout cas dans sa composition, il groupe d'une façon claire et logique la plupart des phénomènes atmosphériques. Il est riche de faits et d'idées et néanmoins d'une lecture facile et agréable."

La Nature, Paris, 16 Avril, 1921.

"In this book Professor Humphreys gives us a large amount of information about the mechanics and thermodynamics of the atmosphere, and puts forward many interesting explanations and suggestions. The book covers a large range and by no means takes the form of an ordinary text-book of meteorology. The chapters on atmospheric optics are particularly welcome and cover a want long felt by English readers." * * * *

Quarterly Journal of the Royal Meteorological Society, London, April, 1921.

"Meteorology and general phenomena of the atmosphere are the subjects touched upon in this elaborate book which is published under the auspices of The Franklin Institute. An authoritative aspect would be given to it by this fact alone, were such needed, but the authorship of the book is enough to give it full weight." * * *

"But throughout the work will be found so many points of interest, that, while the science and mathematics of the subject are given fully, the book retains the aspect of literary value very well, so we can certainly recommend it to our readers."

Science and Invention, New York, September, 1921.

"Traité considérable et détaillé, où sont discutées toutes les questions en rapport avec l'atmosphère qui intéressent la physique du globe. Les lignes suivantes, extraites de la conclusion, en indiquent bien l'esprit et les tendances générales." * * * *

La Géographie, Paris, January, 1922

"* * * * Brings together from many sources descriptions and explanations of the numerous and complex phenomena of our atmosphere." * * *

Scientific American, New York, May, 1922.

"* * * * Professor Humphreys has succeeded in gathering together in an orderly manner the various facts and theories, that comprise the Physics of the Air. The book is invaluable to the student of atmospheric."

The Coast Artillery Journal, Fortress Monroe, Virginia, December, 1922.

CONTENTS

| | |
|---|-----|
| OFFICERS AND COMMITTEES, 1923 | 5 |
| PAST OFFICERS, 1824-1923 | 11 |
| PAST CHAIRMEN, COMMITTEE ON SCIENCE AND THE ARTS, 1834-1923 . . | 17 |
| THE INSTITUTE'S ACTIVITIES | 18 |
| HISTORICAL EXTRACTS | 25 |
| CHARTER AND BY-LAWS | 42 |
| AWARDS BY THE INSTITUTE | 58 |
| REGULATIONS OF THE COMMITTEE ON SCIENCE AND THE ARTS | 64 |
| ANNUAL REPORTS | 74 |
| THE FRANKLIN INSTITUTE AWARDS, 1922-23 | 106 |
| THE FRANKLIN INSTITUTE AWARDS, 1835-1923 | 107 |
| MEETINGS AND LECTURES, 1922-23 | 157 |
| TERMS AND PRIVILEGES OF MEMBERSHIP | 164 |
| MEMBERSHIP DIRECTORY | 165 |

"Bref le livre de M. Humphreys est un ouvrage de synthèse, original en plusieurs de ses parties et en tout cas dans sa composition, il groupe d'une façon claire et logique la plupart des phénomènes atmosphériques. Il est riche de faits et d'idées et néanmoins d'une lecture facile et agréable."

La Nature, Paris, 16 Avril, 1921.

"In this book Professor Humphreys gives us a large amount of information about the mechanics and thermodynamics of the atmosphere, and puts forward many interesting explanations and suggestions. The book covers a large range and by no means takes the form of an ordinary text-book of meteorology. The chapters on atmospheric optics are particularly welcome and cover a want long felt by English readers." * * * *

Quarterly Journal of the Royal Meteorological Society, London, April, 1921.

"Meteorology and general phenomena of the atmosphere are the subjects touched upon in this elaborate book which is published under the auspices of The Franklin Institute. An authoritative aspect would be given to it by this fact alone, were such needed, but the authorship of the book is enough to give it full weight." * * *

"But throughout the work will be found so many points of interest, that, while the science and mathematics of the subject are given fully, the book retains the aspect of literary value very well, so we can certainly recommend it to our readers."

Science and Invention, New York, September, 1921.

"Traité considérable et détaillé, où sont discutées toutes les questions en rapport avec l'atmosphère qui intéressent la physique du globe. Les lignes suivantes, extraites de la conclusion, en indiquent bien l'esprit et les tendances générales." * * * *

La Géographie, Paris, January, 1922

"* * * * Brings together from many sources descriptions and explanations of the numerous and complex phenomena of our atmosphere. * * *"

Scientific American, New York, May, 1922.

"* * * * Professor Humphreys has succeeded in gathering together in an orderly manner the various facts and theories, that comprise the Physics of the Air. The book is invaluable to the student of atmospherics."

The Coast Artillery Journal, Fortress Monroe, Virginia, December, 1922.

CONTENTS

| | |
|---|-----|
| OFFICERS AND COMMITTEES, 1923 | 5 |
| PAST OFFICERS, 1824-1923 | 11 |
| PAST CHAIRMEN, COMMITTEE ON SCIENCE AND THE ARTS, 1834-1923 | 17 |
| THE INSTITUTE'S ACTIVITIES | 18 |
| HISTORICAL EXTRACTS | 25 |
| CHARTER AND BY-LAWS | 42 |
| AWARDS BY THE INSTITUTE | 58 |
| REGULATIONS OF THE COMMITTEE ON SCIENCE AND THE ARTS | 64 |
| ANNUAL REPORTS | 74 |
| THE FRANKLIN INSTITUTE AWARDS, 1922-23 | 106 |
| THE FRANKLIN INSTITUTE AWARDS, 1835-1923 | 107 |
| MEETINGS AND LECTURES, 1922-23 | 157 |
| TERMS AND PRIVILEGES OF MEMBERSHIP | 164 |
| MEMBERSHIP DIRECTORY | 165 |

OFFICERS AND COMMITTEES, 1923

PRESIDENT

WALTON CLARK

VICE-PRESIDENTS

CHARLES DAY

HENRY HOWSON

W. C. L. EGLIN

SECRETARY

R. B. OWENS

TREASURER

BENJAMIN FRANKLIN

BOARD OF TRUSTEES

JOHN HAMPTON BARNES, President

W. L. AUSTIN

JOHN GRIEBEL

CHARLES E. BRINLEY

ALFRED C. HARRISON

WALTON CLARK

FREDERICK ROSENGARTEN

BOARD OF MANAGERS*

GELLERT ALLEMAN

HARRY F. KELLER

CHARLES E. BONINE

JOHN B. KLUMPP

FRANCIS T. CHAMBERS

ROBERT W. LESLEY

G. H. CLAMER

EDW. V. McCAFFREY

THEOBALD F. CLARK

MARSHALL S. MORGAN

WALTON FORSTALL

LAWRENCE T. PAUL

BENJAMIN FRANKLIN

JAMES S. ROGERS

CLARENCE A. HALL

GEORGE D. ROSENGARTEN

ALFRED C. HARRISON

E. H. SANBORN

NATHAN HAYWARD

HASELTINE SMITH

CHARLES A. HEXAMER

C. C. TUTWILER

GEORGE A. HOADLEY

J. T. WALLIS

WILLIAM CHATTIN WETHERILL

* The President, Vice-Presidents, Secretary, Treasurer and the Chairman of the Committee on Science and the Arts are ex-officio members of the Board of Managers.

ARCHITECT

JOHN T. WINDRIM

STAFF

R. B. OWENS, D.S.O., D.Sc., E.E., M.A., F.R.S.C., Secretary; Editor of the JOURNAL OF THE FRANKLIN INSTITUTE; Director, the Bartol Research Foundation.

ALFRED RIGLING, Librarian; Assistant Editor, JOURNAL OF THE FRANKLIN INSTITUTE.

T. R. PARRISH, B.E., Actuary; Assistant to the Director, the Bartol Research Foundation; Assistant to the Committee on Science and the Arts.

ANN B. HUDSON, Executive Assistant to the Secretary.

WALTER A. R. PERTUCH, Assistant Librarian; Superintendent of Building.

MARY L. COFFIN, Secretary to Science and the Arts Assistant.

MARTHA B. GROFF, Secretary to the Director, Bartol Research Foundation.

ISABELLA GRIFFITH, Bookkeeper.

MARGARET A. BIRKETT, Secretary to Librarian.

EMMA EWING, Cataloguer.

MARY B. COBLE, Telephone Operator.

HOWARD ARMSTRONG, Office Assistant.

THOMAS CARROLL, Library Clerk.

COMMITTEES OF THE BOARD OF MANAGERS

COMMITTEE ON ELECTION AND RESIGNATION OF MEMBERS

| | |
|----------------------------|------------------|
| ROBERT W. LESLEY, Chairman | CLARENCE A. HALL |
| GELLERT ALLEMAN | HASELTINE SMITH |
| CHARLES E. BONINE | |

COMMITTEE ON ENDOWMENT

| | |
|------------------------|----------------------|
| G. H. CLAMER, Chairman | NATHAN HAYWARD |
| W. C. L. EGLIN | WILLIAM C. WETHERILL |
| ALFRED C. HARRISON | |

EXECUTIVE COMMITTEE

| | |
|-------------------------|--------------------|
| E. H. SANBORN, Chairman | ALFRED C. HARRISON |
| CHARLES DAY | JAMES S. ROGERS |
| WALTON FORSTALL | |

COMMITTEE ON EXHIBITIONS

| | |
|-----------------------------|--------------------|
| BENJAMIN FRANKLIN, Chairman | CHARLES DAY |
| FRANCIS T. CHAMBERS | CHARLES A. HEXAMER |
| THEOBALD F. CLARK | |

FRANKLIN FUND AND BUILDING COMMITTEE

| | |
|------------------------|-------------------------|
| HENRY HOWSON, Chairman | WALTON CLARK, Treasurer |
| | ALFRED C. HARRISON |

COMMITTEE ON INSTRUCTION

| | |
|----------------------------|-------------------|
| LAWRENCE T. PAUL, Chairman | EDW. V. McCAFFREY |
| GEO. A. HOADLEY | J. T. WALLIS |
| HARRY F. KELLER | |

COMMITTEE ON PUBLICATIONS

| | |
|---------------------------------|-------------------|
| GEORGE D. ROSENGARTEN, Chairman | GEORGE A. HOADLEY |
| GELLERT ALLEMAN | E. H. SANBORN |
| W. C. L. EGLIN | |

Editorial Staff of the Journal**R. B. OWENS, Editor****Associate Editors**

Joseph S. Ames
 Wilder D. Bancroft
 Brig. Gen. John J. Carty
 E. G. Coker
 A. S. Cushman
 Arthur L. Day
 A. S. Eve
 W. J. Humphreys
 Harry F. Keller
 A. E. Kennelly

C. E. K. Mees
 Ralph Modjeski
 Maj. Gen. Geo. O. Squier
 C. P. Steinmetz
 S. W. Stratton
 W. F. G. Swann
 Chief Con. D. W. Taylor, U. S. N.
 A. F. Zahm
 John Zeleny

COMMITTEE ON SECTIONAL ARRANGEMENTS

HARRY F. KELLER, Chairman
 GELLERT ALLEMAN
 JOHN B. KLUMPP

ROBERT W. LESLEY
 C. C. TUTWILER

COMMITTEE ON STOCKS AND FINANCE

WALTON FORSTALL, Chairman
 BENJAMIN FRANKLIN
 ALFRED C. HARRISON

JAMES S. ROGERS
 E. H. SANBORN

COMMITTEES OF THE INSTITUTE

COMMITTEE ON LIBRARY

| | |
|----------------------------|---------------------|
| CLARENCE A. HALL, Chairman | GEORGE A. HOADLEY |
| CHARLES E. BONINE | HARRY F. KELLER |
| G. H. CLAMER | C. W. MASLAND |
| H. J. M. CREIGHTON | MARSHALL S. MORGAN |
| W. H. FULWEILER | GEORGE F. STRADLING |

COMMITTEE ON MEETINGS

| | |
|---------------------------|---------------------|
| GELLERT ALLEMAN, Chairman | W. H. FULWEILER |
| JOSEPH S. AMES | HERBERT E. IVES |
| G. H. CLAMER | A. E. KENNELLY |
| ALLERTON S. CUSHMAN | RALPH MODJESKI |
| ARTHUR L. DAY | GEO. D. ROSENGARTEN |

COMMITTEE ON MUSEUM

| | |
|----------------------------------|-------------------|
| A. E. OUTERBRIDGE, JR., Chairman | GEORGE A. HOADLEY |
| HUGO BILGRAM | C. W. MASLAND |
| ARTHUR L. CHURCH | CHARLES PENROSE |
| CHARLES DAY | H. H. QUIMBY |
| W. C. L. EGLIN | |

BARTOL RESEARCH FOUNDATION COMMITTEE

| | |
|--------------------------|--------------------|
| C. C. TUTWILER, Chairman | CHARLES DAY |
| JOSEPH S. AMES | MARSHALL S. MORGAN |
| WALTON CLARK | R. B. OWENS |
| ARTHUR L. DAY | |

LABORATORY BUILDING COMMITTEE

| | |
|--------------------------|--------------|
| NATHAN HAYWARD, Chairman | HENRY HOWSON |
| WALTON CLARK | R. B. OWENS |
| CHARLES DAY | |

COMMITTEE ON SCIENCE AND THE ARTS

W. H. FULWEILER, Chairman

HENRY B. ALLEN

EUGENE E. AYRES, JR.

JAMES BARNES

CLIFFORD W. BATES

GEORGE H. BENZON, JR.

HUGO BILGRAM

CARL P. BIRKINBINE

CHARLES E. BONINE

ROGER F. BRUNEL

HAROLD CALVERT

G. H. CLAMER

EDWARD L. CLARK

THEOBALD F. CLARK

THOMAS D. COPE

GEORGE S. CRAMPTON

H. J. M. CREIGHTON

GEORGE S. CULLEN

P. T. DASHIELL

SAMUEL B. ECKERT

W. C. L. EGLIN

OWEN B. EVANS

ISAAC H. FRANCIS

BENJAMIN FRANKLIN

CHARLES D. GALLOWAY

CLARENCE A. HALL

JOSEPH S. HEPBURN

GEORGE A. HOADLEY

S. C. HOLLISTER

W. N. JENNINGS

WILLIAM H. KAVANAUGH

HARRY F. KELLER

LIONEL F. LEVY

LEO LOEB

K. G. MACKENZIE

CHARLES W. MASLAND

EDWARD V. McCAFFREY

J. Y. McCONNELL

STEPHEN H. NOYES

FREDERIC PALMER, JR.

CHARLES PENROSE

M. M. PRICE

H. H. QUIMBY

FRANK H. ROGERS

JAMES S. ROGERS

L. F. RONDINELLA

WILLIAM OTIS SAWTELLE

J. M. RUSBY

WILLIAM H. THORNE

JOHN C. TRAUTWINE, 3rd.

C. C. TUTWILER

JAMES G. VAIL

JOHN A. VOGLESON

FRANCIS R. WADLEIGH

JOHN M. WEISS

WM. CHATTIN WETHERILL

ROBERT L. WOOD

WINTHROP R. WRIGHT

Standing Sub-Committees**The Franklin Medal**

HARRY F. KELLER, Chairman

JAMES BARNES

G. H. CLAMER

H. J. M. CREIGHTON

Literature

HARRY F. KELLER, Chairman

CHARLES E. BONINE

ROGER F. BRUNEL

H. J. M. CREIGHTON

LIONEL F. LEVY

J. M. RUSBY

New Subjects and Preliminary Examination

H. J. M. CREIGHTON, Chairman

CHARLES E. BONINE

GEORGE S. CRAMPTON

BENJAMIN FRANKLIN

NATHAN HAYWARD

LIONEL F. LEVY

CHARLES PENROSE

M. M. PRICE

JAMES S. ROGERS

PAST OFFICERS

1824-1923

PRESIDENTS

| | |
|--------------------------------|-------------------------------|
| BANES, CHARLES H., 1886 | ROGERS, ROBERT E., 1875-1878 |
| BIRKINBINE, JOHN, 1897-1906 | RONALDSON, JAMES, 1824-1841 |
| CLARK, WALTON, 1907- | SELLERS, COLEMAN, 1870-1874 |
| CRESSON, JOHN C., 1855-1863 | SELLERS, WILLIAM, 1864-1866 |
| MERRICK, J. VAUGHAN, 1867-1869 | TATHAM, WILLIAM P., 1879-1885 |
| MERRICK, SAMUEL V., 1842-1854 | WILSON, JOSEPH M., 1887-1896 |

VICE-PRESIDENTS

| | |
|--|--------------------------------------|
| AGNEW, JOHN, 1851, 1855-1863 | HEYL, HENRY R., 1895-1897 |
| BALDWIN, MATTHIAS W., 1855-1863 | HOWSON, HENRY, 1904- |
| BECK, PAUL, JR., 1826-1827 | JONES, WASHINGTON, 1900-1910 |
| BULLOCK, CHARLES, 1879-1900 | LEVY, LOUIS E., 1916-1919 |
| CAREY, MATTHEW, 1824-1828 | LONGSTRETH, EDWARD, 1890-1894 |
| CARTWRIGHT, HENRY, 1880-1881 | LUKENS, ISAIAH, 1824-1825, 1829-1846 |
| CHRISTIE, JAMES, 1911 | MILLER, ABRAHAM, 1847-1854 |
| CLOSE, CHARLES S., 1875-1879 | MITCHELL, J. E., 1876-1887 |
| CRESSON, GEORGE V., 1898-1903 | MOORE, BLOOMFIELD H., 1869-1876 |
| DAY, CHARLES, 1920- | MORRIS, HENRY G., 1870-1879 |
| DODGE, JAMES M., 1903-1915 | RAND, THEODORE D., 1897-1903 |
| EGLIN, W. C. L., 1922- | ROGERS, FAIRMAN, 1864-1866 |
| EREBY, GEORGE, 1867 | ROGERS, ROBERT E., 1868-1874 |
| FLETCHER, THOMAS, 1828-1850, 1852-1854 | SELLERS, COLEMAN, 1867-1869 |
| FRAZER, JOHN F., 1865-1866 | SELLERS, COLEMAN, JR., 1912-1922 |
| GRAFF, FREDERICK, 1882-1890 | TATHAM, WILLIAM P., 1888-1897 |
| | TOWNE, JOHN H., 1864-1868 |

RECORDING SECRETARIES

| | |
|--------------------------------------|--------------------------------|
| BULKLEY, JAMES H., 1831-1832 | PEROT, WILLIAM S., 1833-1834 |
| GARRIGUES, ISAAC B., 1830, 1837-1863 | ROBERTS, ALGERNON S., 1829 |
| JONES, THOMAS P., 1827-1828 | STRICKLAND, WILLIAM, 1824-1826 |
| JONES, WASHINGTON, 1864 | TRAUTWINE, JOHN C., 1835-1836 |

CORRESPONDING SECRETARIES

| | |
|-------------------------------|--------------------------------|
| BACHE, ALEX DALLAS, 1840-1844 | FRALEY, FREDERICK, 1855-1863 |
| BRIGGS, ROBERT, 1864 | FRAZER, JOHN F., 1845-1847 |
| BROWNE, PETER A., 1824-1827 | HAYS, ISAAC, 1828-1839 |
| CRESSON, JOHN C., 1854 | ROBERTS, SOLOMON W., 1848-1853 |

SECRETARIES

| | |
|--------------------------|------------------------------------|
| CHRISTIE, JAMES, 1909 | OWENS, ROBERT B., 1910- |
| KNIGHT, J. B., 1875-1879 | WAHL, WILLIAM H., 1871-1874, 1882- |
| MORTON, HENRY, 1865-1870 | 1908 |
| NORRIS, ISAAC, 1879-1881 | |

TREASURERS

| | |
|---|-------------------------------|
| BORGNER, CYRUS, 1908-1920 | MERRICK, SAMUEL V., 1828-1829 |
| FLETCHER, THOMAS, 1824-1825 | RICHARDSON, JOHN, 1826-1827 |
| FRALEY, FREDERICK, 1830-1847, 1865-1882 | SARTAIN, SAMUEL, 1883-1906 |
| FRANKLIN, BENJAMIN, 1920- | TREGO, CHARLES B., 1847 |
| FRAZER, JOHN F., 1848-1864 | WAHL, WILLIAM H., 1907 |

ACTUARIES

| | |
|--|----------------------------------|
| CHRISTIE, JAMES, Feb. 21-June 11, 1908 | JESTER, SIMEON VAN T., 1916-1918 |
| HAMILTON, WILLIAM, 1828-1871 | LARZELERE, JAMES S., 1908-1916 |
| HEYL, HERBERT L., 1885-1908 | PARRISH, T. R., 1922- |
| HOLMAN, DAVID S., 1872-1885 | ROBINSON, LOUIS C., 1918-1922 |
| | WAHL, WILLIAM H., 1872 |

LIBRARIANS

| | |
|--------------------------------|------------------------|
| HILTEBRAND, EMANUEL, 1874-1887 | RIGLING, ALFRED, 1887- |
|--------------------------------|------------------------|

MANAGERS

| | |
|---|------------------------------------|
| ABBOT, WILLIAM, 1824-1826 | BAUGH, HARMAN, 1855 |
| ADAMSON, WILLIAM, 1864 | BEALE, JOSEPH, 1827 |
| ADDICKS, JOHN E., 1845-1850 | BEARDSLEY, ARTHUR, 1894-1902 |
| AGNEW, JOHN, 1831-1850, 1852-1854 | BECK, PAUL, JR., 1824-1825 |
| ALLEMAN, GELLERT, 1918- | BEMENT, CLARENCE S., 1871 |
| ALLEN, JAMES, 1845 | BEMENT, WILLIAM B., 1866-1870 |
| ALLISON, WILLIAM C., 1863 | BERGNER, THEODORE, 1870-1875 |
| ARCHER, ELLIS S., 1858-1859 | BETTS, WILLIAM C., 1844 |
| BACHE, ALEX. DALLAS, 1830-1839 | BIDDLE, CLEMENT C., 1824 |
| BALCH, EDWIN S., 1902-1912 | BILGRAM, HUGO, 1885-1890 |
| BALDWIN, MATTHIAS W., 1827-1854 | BIRKBECK, JOHN, 1869-1871 |
| BANES, CHARLES H., 1877-1885, 1887-1895 | BIRKINBINE, HENRY P. M., 1851-1856 |
| BARKER, GEORGE F., 1874-1875 | BIRKINBINE, JOHN, 1907-1915 |
| BARRAS, JOSEPH J., 1851-1860 | BOLTON, JAMES M., 1830 |
| BARTOL, BARNABAS H., 1863-1865 | BONINE, CHARLES E., 1921- |
| BARTOL, HENRY W., 1870-1878 | BORGNER, CYRUS, 1903-1907 |
| BAUGH, DANIEL, 1900-1902 | BOSWELL, WILLIAM L., 1896-1898 |
| | BOWER, HENRY, 1891-1896 |

MANAGERS—(Continued)

- BRIGGS, ROBERT, 1867-1873
 BROCK, ROBERT C. H., 1901-1906
 BROLASKY, HENRY C., 1897-1902
 BRYSON, JAMES H., 1857-1863
 BULKLEY, JAMES H., 1830, 1833-1841
 BULLOCK, CHARLES, 1868-1878
 BURNHAM, GEORGE, 1878
 BURTIS, AARON H., 1845
 CARR, WILLIAM H., 1837-1845
 CARTWRIGHT, HENRY, 1865-1879
 CHABOT, CYPRIEN, 1877-1889
 CHAMBERS, CYRUS, JR., 1876-1890
 CHAMBERS, FRANCIS T., 1913-
 CHASE, PLINY E., 1864-1886
 CHRISTIE, JAMES, 1897-1908
 CLAMER, G. H., 1917-
 CLARK, THEOBALD F., 1917-
 CLARK, WALTON, 1903-1906
 CLARKE, JAMES, 1824-1826
 CLOSE, CHARLES S., 1865-1874
 CLOUD, JOSEPH, 1824
 CODMAN, JOHN E., 1892-1894
 COLLINS, ISAAC, 1828
 CONARD, THOMAS P., 1894-1908
 CONARROE, GEORGE W., 1851-1863
 COOPER, JOHN H., 1870-1873
 COPPER, JOHN C., 1851
 CORNELIUS, ROBERT, 1855-1863
 CORNELIUS, ROBERT C., 1866-1868
 CRAMP, CHARLES H., 1864-1867, 1875,
 1895-1897
 CRESSON, GEORGE V., 1886-1897
 CRESSON, JOHN C., 1835-1853
 CRESSON, WILLIAM P., 1848-1849
 DARRACH, CHARLES G., 1894-1896
 DAY, CHARLES, 1908-1919
 DIVINE, WILLIAM, 1864
 DODGE, KERN, 1916-1920
 DODGE, JAMES M., 1896-1903
 DONALDSON, JOSEPH, 1825
 DOUGHERTY, JAMES, 1858-1861
 DRAPER, EDMUND, 1847-1850
 DREER, FERDINAND J., 1862
 DROWN, WILLIAM A., 1861-1863
 DU BOIS, WILLIAM L., 1880-1882
 DURFEE, WILLIAM F., 1872-1873
 EASTWICK, ANDREW M., 1836-1844
 EASTWICK, EDWARD P., 1859-1860
 EBERT, MORRIS, 1908-1911
 ECKERT, GEORGE M., 1852-1854
 EGLIN, W. C. L., 1908-1922
 EISENHUT, JOHN D., 1824-1825
 ELDRIDGE, G. MORGAN, 1885-1890
 ELLIS, JAMES P., 1848-1851
 EMERSON, G., 1828
 EREBY, GEORGE, 1854-1866
 EVANS, OWEN, 1844-1857
 FARR, GEORGE W., 1851
 FERGUSON, ALEXANDER, 1831-1841
 FLETCHER, THOMAS, 1826-1827
 FLING, WILLIAM B., 1842
 FORSTALL, WALTON, 1908-
 FOX, GEORGE, 1828-1830
 FRALEY, FREDERICK, 1829, 1848-1854
 FRANKLIN, BENJAMIN, 1917-
 FRAZER, JOHN F., 1844, 1865-1866
 FRAZER, PERSIFOR, 1880-1891, 1903-
 1909
 FRAZIER, GEORGE H., 1898
 FRENCH, HOWARD B., 1900
 FRY, WILLIAM, 1825
 GARDINER, JOHN, JR., 1864
 GARRIGUES, ISAAC B., 1825-1829, 1831-
 1836
 GARRISON, F. LYNWOOD, 1890-1895,
 1897-1903
 GAWTHROP, HENRY, 1896-1898
 GIBBS, ALFRED W., 1915-1922
 GIBSON, J. HOWARD, 1893-1894
 GIBSON, JOHN J., 1912-1915
 GILDER, JOHN, 1838-1841
 GILPIN, THOMAS, 1824
 GOBRECHT, CHRISTIAN, 1828-1830
 GOLDSMITH, E., 1908-1916

MANAGERS—(Continued)

- GRAHAM, HOWARD S., 1920-1921
 GRAFF, FREDERICK, 1852-1854, 1858-1865, 1880-1881
 GREBLE, EDWIN, 1841-1863
 GREENE, STEPHEN, 1898-1908
 GRIES, JOHN M., 1858-1862
 GRIFFITH, R. EGGLESFIELD, 1870-1871
 GRIFFITH, ROBERT E., 1827
 GROVES, DANIEL, 1824-1827
 HALL, CLARENCE A., 1922-
 HAND, JAMES C., 1845-1846
 HANSELL, WILLIAM S., 1827
 HARDING, GEORGE, 1864-1865
 HARKER, JOSHUA G., 1831-1836
 HARPER, JAMES, 1824-1826
 HARRIS, WILLIAM, 1860-1863
 HARRISON, ALFRED C., 1895-
 HARRISON, C. LELAND, 1899-1902
 HARRISON, JOHN, 1824-1829
 HARRISON, JOSEPH, JR., 1854, 1856-1859
 HART, SAMUEL, 1865-1870
 HAVILAND, JOHN, 1824-1826
 HAYS, ISAAC, 1840-1841
 HAYWARD, NATHAN, 1917-
 HELLER, CHARLES S., 1879-1880
 HELME, WILLIAM, 1869-1888
 HENDERSON, GEORGE R., 1915-1921
 HERSE, GEORGE P., 1851
 HEXAMER, CHARLES A., 1904-
 HEYL, HENRY R., 1879-1895, 1898-1909
 HOADLEY, GEORGE A., 1911-
 HORN, HENRY, 1824
 HORSTMANN, WILLIAM J., 1865-1868
 HOUSTON, EDWIN J., 1874-1897
 HOWARD, GEORGE C., 1855-1858
 HOWE, HERBERT M., 1898-1900
 HOWSON, CHARLES HENRY, 1903-1907
 HOWSON, HENRY, 1898-1903
 HUFTY, SAMUEL, 1834-1850
 HUMPHREYS, SAMUEL, 1826
 HUNTER, JAMES, 1864
 HUTCHINSON, CHARLES H., 1888-1890
 HUTCHINSON, JAMES, 1841-1842
 HUTCHINSON, JOSEPH, 1860-1863
 JAYNE, HARRY W., 1891-1910
 JENNINGS, W. N., 1896
 JOHNSON, LAWRENCE, 1855-1859
 JONES, THOMAS P., 1826
 JONES, WASHINGTON, 1859-1895, 1897-1900
 KATEZ, I., 1824
 KEATING, WILLIAM H., 1824-1826, 1830-1840
 KELLER, HARRY F., 1914-
 KELLY, HENRY H., 1851
 KING, ROBERT P., 1851
 KIRK, CHARLES H., 1830
 KIRKPATRICK, GEORGE E., 1911-1914
 KLUMPP, JOHN BARTLEMAN, 1923
 KNEASS, WILLIAM, 1825
 KNIGHT, DANIEL R., 1845
 KRUMBHAAR, ALEXANDER, 1898-1911
 KUHN, C. HARTMAN, 1896-1905
 LAMBERT, WM. H., 1906
 LESLEY, ROBERT W., 1913-
 LE VAN, W. BARNET, 1864-1876
 LEVY, LOUIS E., 1903-1915
 LEWIS, ENOCH, 1868-1894
 LEWIS, HARVEY, 1824-1827
 LEWIS, MORDECAI D., 1828-1836
 LINDSAY, JOHN, 1843
 LINDSAY, ROBERT, 1834-1836
 LINNARD, JAMES M., 1836-1838
 LINVILLE, J. HAYES, 1868
 LONGSTRETH, CHARLES, 1903-1907
 LONGSTRETH, EDWARD, 1868-1870, 1895-1897
 LOUD, THOMAS, 1829-1831
 LOVE, WILLIAM H., 1859
 LUCAS, JOHN, 1888-1894
 LUKENS, ISAIAH, 1828
 LUKENS, JAWOOD, 1902-1908
 LYMAN, BENJAMIN S., 1901-1902
 McALPINE, JAMES, 1825-1828
 McCaffrey, E. V., 1910-
 McCAMBRIDGE, RICHARD, 1876

MANAGERS—(Continued)

- MCCLURE, JOHN, 1853-1856
 MCCLURG, ALEXANDER, 1833-1839
 MCEUEN, THOMAS, 1829
 MCKEAN, WILLIAM V., 1879-1883
 MARKS, WILLIAM D., 1881-1884
 MARSHALL, SAMUEL R., 1887-1893
 MASON, DAVID H., 1824
 MASON, JAMES S., 1861
 MEGARGEE, CHARLES, 1858
 MEIRS, RICHARD WALN, 1908-1917
 MERRICK, J. VAUGHAN, 1864-1866,
 1870-1884
 MERRICK, SAMUEL V., 1824-1827,
 1830-1841, 1855-1863
 MIFFLIN, LLOYD, 1825-1826
 MILES, FREDERICK B., 1874
 MILLER, ABRAHAM, 1824-1846, 1855-
 1858
 MITCHELL, J. E., 1874
 MITCHELL, WILLIAM A., 1864-1865
 MORRIS, ISAAC P., 1836-1843
 MOORE, BLOOMFIELD H., 1864-1868
 MOORE, JOSEPH W., 1860-1861
 MORGAN, MARSHALL S., 1914-
 MORRIS, ELWOOD, 1844-1847
 MORRIS, HENRY G., 1864-1869
 MORRIS, WILLIAM E., 1847-1851
 MUCKLE, M. RICHARDS, JR., 1894-1896
 NAYLOR, JACOB, 1863, 1865-1872
 NEAFIE, JACOB G., 1868
 NEWHALL, PAUL W., 1843-1844
 NORRIS, ISAAC, 1870-1878, 1883-1918
 NYSTROM, JOHN W., 1873-1875
 OGDEN, JOHN M., 1833
 OGLE, WILLIAMS, 1845-1850
 O'NEILL, JOHN, 1827-1832
 ORR, HECTOR, 1871-1887
 OUTERBRIDGE, ALEX. E., JR., 1881-1886
 PALMER, B. FRANKLIN, 1862
 PARRISH, WILLIAM D., 1838, 1852-
 1854
 PARRY, CHARLES T., 1864
 PATTERSON, ROBERT, 1824
 PATTERSON, ROBERT M., 1825-1827
 PAUL, LAWRENCE T., 1895-
 PEMBERTON, HENRY, JR., 1891-1896
 PERRY, ROBERT S., 1912-1916
 PETTIT, HORACE, 1894-1910
 PURVES, ALEXANDER, 1875-1876
 RALSTON, ASHBEL G., 1825-1830
 RAMAGE, ADAM, 1824-1832
 RAND, THEODORE D., 1874-1897
 REED, WILLIAM B., 1832-1836
 REEVES, BENJAMIN, 1829-1837
 REEVES, SAMUEL J., 1864
 REEVES, STACY, 1889-1902
 RICE, JOHN, 1866-1867
 RICHARDS, MARK, 1831
 RICHARDSON, JOHN, 1825
 RIEHLE, HENRY J., 1826-1827
 ROBBINS, SAMUEL J., 1827-1833
 ROBERTS, ALGERNON S., 1828
 ROBERTS, PERCIVAL, 1864-1868
 ROBERTS, SOLOMON W., 1842-1847
 ROBINSON, ALEXANDER P., 1911-1916
 ROGERS, EVANS, 1854-1863
 ROGERS, HENRY D., 1838-1843
 ROGERS, JAMES S., 1909-
 ROGERS, ROBERT E., 1867
 RONALDSON, CHARLES E., 1885-1893,
 1908-1912
 ROSENGARTEN, GEORGE D., 1912-
 ROWLAND, JAMES, JR., 1829-1830
 ROWLAND, WILLIAM, 1828
 RUSH, WILLIAM, 1825
 RUST, JAMES I., 1824
 SADTLER, SAMUEL P., 1888-1897
 SANBORN, E. H., 1907-
 SARTAIN, JOHN, 1877-1879
 SARTAIN, SAMUEL, 1865-1882
 SAVERY, PELEG B., 1851-1852
 SAXTON, JOSEPH, 1842-1844
 SAY, BENJAMIN, 1832-1833
 SCATTERGOOD, THOMAS, 1829-1834
 SCHAUM, OTTO W., 1907
 SCHREINER, JOSEPH H., 1827-1832
 SCHUMANN, FRANCIS, 1899-1902
 SEIPER, THOMAS, 1824

MANAGERS—(Continued)

- SELLERS, COLEMAN, 1862-1866, 1875-1905
 SELLERS, COLEMAN, JR., 1906-1911
 SELLERS, WILLIAM, 1857-1861, 1867-1892
 SHAIN, CHARLES J., 1884-1887
 SHINN, EARLE, 1836-1837
 SLOAN, SAMUEL, 1864
 SMITH, CHARLES E., 1852-1855
 SMITH, HASELTINE, 1922-
 SOUDER, JACOB, 1828
 SPANGLER, HENRY W., 1891-1893
 STEVENSON, WILLIAM, JR., 1828
 STEWART, THOMAS S., 1842-1850, 1852-1863
 STRICKLAND, WILLIAM, 1828
 STRUTHERS, JOHN, 1827-1849
 TABER, GEORGE, 1839-1842
 TATHAM, WILLIAM P., 1870-1878, 1886-1887
 THOMPSON, AMBROSE W., 1839-1843
 THOMSON, ELIHU, 1878-1881
 THORNE, WILLIAM H., 1881-1897
 THORNLEY, JOHN, 1851
 TILGHMAN, BENJ. C., 1871-1875
 TOPPAN, CHARLES, 1831-1832
 TOWNE, JOHN H., 1840-1857, 1869
 TOWNSEND, EDWARD Y., 1866-1867
 TRACY, ELIASHIB, 1851
 TRAUTWINE, JOHN C., 1834, 1844, 1852-1857
 TRAUTWINE, JOHN C., JR., 1891-1895
 TREGO, CHARLES B., 1837-1846
 TREVOR, JOHN B., 1832
 TROTH, HENRY, 1837-1841
 TRYSON, GEORGE W., 1831-1833
 TUTWILER, C. C., 1920-
 TYLER, RUFUS, 1826-1837
 VAUCLAIN, SAMUEL M., 1898, 1906
 VAUX, GEORGE, JR., 1898-1899
 WALLIS, J. T., 1923-
 WALTER, JOSEPH S., JR., 1834-1837
 WALTER, THOMAS U., 1829-1831, 1840-1851
 WARDER, WILLIAM S., 1825-1827
 WARNER, JOHN S., 1837-1843
 WEAVER, JACOB, 1856-1857
 WEAVER, JOHN J., 1880-1891
 WEIGHTMAN, WILLIAM, 1862-1863
 WETHERILL, CHARLES, 1835
 WETHERILL, J. P., 1902
 WETHERILL, JOHN P., 1824-1825
 WETHERILL, WILLIAM, 1832
 WETHERILL, WILLIAM C., 1916-
 WEYGANDT, THOMAS J., 1851-1863
 WHARTON, WILLIAM, JR., 1871
 WHITAKER, GEORGE P., 1851-1852
 WHITE, CHARLES H., 1828-1835
 WHITE, SAMUEL S., 1864-1867
 WHITNEY, ASA, 1846-1850
 WHITNEY, GEORGE, 1858-1860
 WHITNEY, JAMES S., 1862-1863, 1865-1869
 WHITNEY, JOHN R., 1861
 WICKHAM, M. T., 1824
 WIEGAND, JOHN, 1831-1853
 WIEGAND, S. LLOYD, 1864, 1890-1893
 WILLIAMS, EDWARD H., 1871-1872
 WILLIAMS, ISAAC S., 1846-1850, 1852-1863
 WILSON, JOSEPH M., 1869-1886
 WILSON, O. HOWARD, 1864-1869
 WOLBORN, CORNELIUS A., 1844-1850
 WOLF, OTTO C., 1897-1913
 WOOD, ALAN, 1845-1863
 WOOD, SAMUEL R., 1824-1825
 WOOD, WALTER, 1903-1912
 WOOTTEN, JOHN E., 1860-1862
 YARDLEY, WILLIAM, JR., 1829
 YEAGER, JOSEPH, 1832
 YOUNG, ANDREW, 1828-1830

PAST CHAIRMEN OF THE COMMITTEE ON SCIENCE AND THE ARTS

1834-1923

| | |
|--|---|
| BACHE, ALEXANDER D., 1834-1836, 1839-1844 | HOADLEY, GEORGE A., 1911-1912 |
| BARNES, JAMES, 1922-1923 | KOENIG, G. A., 1888-1889 |
| BEARDSLEY, ARTHUR, 1892-1895 | LEVY, LOUIS E., 1901-1902 |
| BILGRAM, HUGO, 1906-1907 | LEWIS, WILFRED, 1912-1913 |
| BONINE, CHARLES E., 1916-1917 | MARBURG, EDGAR, 1899-1900 |
| CHRISTIE, JAMES, 1897-1898 | MARKS, W. D., 1881-1882, 1887-1888 |
| CLAMER, G. H., 1915-1916 | MASLAND, CHARLES W., 1921-1922 |
| CONARD, THOMAS P., 1902-1903 | McCONNELL, JACOB Y., 1909-1910 |
| CREIGHTON, H. JERMAIN, 1918-1919 | ORR, HECTOR, 1880-1881 |
| CRESSON, J. C., 1844-1874 | PATTERSON, R. M., 1836-1839 |
| CRISFIELD, J. A. P., 1913-1914 | PENROSE, CHARLES, 1920-1921 |
| ELDRIDGE, G. MORGAN, 1896-1897 | ROGERS, JAMES S., 1908-1909 |
| FRANKLIN, BENJAMIN, 1919-1920 | RONALDSON, CHARLES E., 1903-1904 |
| FULWEILER, W. H., 1923- | RONDINELLA, L. F., 1898-1899 |
| GOLDSMITH, EDWARD, 1905-1906 | SARTAIN, SAMUEL, 1895-1896 |
| GRIGGS, WILLIAM O., 1907-1908 | SELLERS, COLEMAN, 1875-1880 |
| HAUPT, LEWIS M., 1904-1905 | SPANGLER, H. W., 1890-1891 |
| HENDERSON, GEORGE R., 1914-1915 | SPENCER, THOMAS, 1910-1911 |
| HEYL, HENRY R., 1882-1887, 1893-1894, 1900-1901 | WETHERILL, WM. CHATTIN, 1917-1918 |
| | WIEGAND, S. LLOYD, 1889-1890, 1891- 1892 |

THE INSTITUTE'S ACTIVITIES

THE FRANKLIN INSTITUTE was organized in the year 1824 to meet a demand in America for an Institution similar to that founded by Count Rumford in London in 1799. The founders intended it not only as an appropriate memorial to the name of Franklin, but as a means of continuing for all time a work which throughout his long life he perhaps regarded as his best, namely, the discovery of physical and natural laws and their application to increase the well-being and comfort of mankind.

The Hall of the Institute is located on the east side of Seventh Street, between Market and Chestnut Streets, and was built from plans furnished by John Haviland, architect. The corner-stone was laid with appropriate Masonic and other ceremonies, on the eighth day of June, 1825, at noon. The funds for the purchase of the lot and the erection of the building were provided by the issue of a building loan, which was freely taken by members and friends of the enterprise, and has long since been repaid. The building was completed, and the Institute took possession of all except the second floor (which was occupied by the United States Courts until 1830) in 1826. Upon the first floor are located the lecture-room (capable of accommodating about 300), and laboratories and offices. The second floor is occupied by the library, to which special attention is paid elsewhere. The third floor is given up entirely to the Museum of Models and Historical Apparatus.

THE LIBRARY

The plan of the founders contemplated "the formation of a library of books relating to science and the useful arts, and the opening of a reading-room"; and, accordingly, in 1827, the first Committee on Library was appointed.

The books forming the nucleus of the library were stored in the residence of a member of the committee until early in the year 1829, when the first reading room was opened. During the next year a special committee of twenty issued an appeal for books and contributions of money in aid of the library.

The founding of the JOURNAL, in 1826, by opening the way to the establishment of exchange relations with other societies and with the leading magazines and periodicals devoted to science and the useful arts, proved an invaluable help in promoting its growth, and thus, early, gave to the library the distinctive character which it has since maintained. From the nucleus formed by this useful agency has grown a reference library of scientific literature, in some branches unique, and, in extent and completeness, second to none in the United States, embracing the publications of the principal scientific and technical societies of the world, and the leading periodicals devoted to science and the arts.

Several of the foreign governments have deposited with the library complete sets of their patent office publications. There are on the shelves for reference files of the specifications of the patent office of Great Britain since the year 1617, of France since 1791, of Switzerland since 1888, of the United States since 1790. Abstracts of the patents granted by Germany, Russia, Canada, Australia, Hungary and Austria can also be consulted.

The library is annually enriched, also, by the gift of numerous technical publications of a miscellaneous character from foreign governments, and from States and municipal authorities and corporations. These embrace publications relating to public works; official reports relating to geology, the mining and metallurgical industries, agriculture, public health, municipal engineering; reports of railway and other transportation companies, manufacturing corporations, etc.

For many years it has been the policy of this committee to increase the value of the collection as a library of reference, and to this end it has devoted systematic efforts to the task of completing the files of its important serial publications. In this work, the committee, with the substantial assistance of several liberal contributions of money from generous friends of the Institute, has been notably successful.

At the present time the collection consists of 81,803 volumes and 20,757 pamphlets.

To inventors and manufacturers seeking for information respecting the state of the arts and manufactures, the extensive collection of patent literature which the library places at their disposal is indispensable, and the library is constantly resorted to by attorneys and their clients for the purpose of consulting these volumes; while, to the professional man and the student, the scientific and technical serials in which the library is so rich are no less indispensable as an aid in pursuing their investigations.

THE COMMITTEE ON SCIENCE AND THE ARTS

A branch of the Institute's work, which, perhaps, more obviously than any other, illustrates the spirit which animated the founders, and which their successors have worthily perpetuated and striven to improve and extend, is that which is now conducted by the Committee on Science and the Arts.

One of the things that was, apparently, uppermost in the thoughts of the founders, was the need—as urgent then as to-day—felt by inventors and discoverers, of some competent, trustworthy and impartial body, to whom they could safely appeal for advice, and on whose judgment they could confidently rely for an opinion, as to the usefulness of their inventions and discoveries.

One of the first acts of the Board of Managers was to appoint a Board of Examiners, whose duty it was to examine and make report upon all new and useful machines, inventions and discoveries submitted to them. Subsequently the name of the Board of Examiners was changed to the "Committee on Inventions."

This organization continued in existence until the year 1834, when, by act of the Institute, it was abolished, and in its place there was established the "Committee on Science and the Arts," with enlarged powers and a wider field of labor. As originally constituted, membership in this committee was open to all members of the Institute in good standing who chose to enroll their names, and who by thus voluntarily associating themselves with the committee, pledged themselves to perform the duties assigned to them.

Under this form of organization the committee continued for more than fifty years, and its usefulness during this long period is attested by its records, containing the results of the examination of a great number of inventions, and of its investigations of many subjects of importance entrusted to it by the Institute.

In the year 1886, the Institute adopted an amendment to its by-laws, by which this committee was reorganized on an elective basis, thus abolishing the plan of voluntary association which had heretofore been a distinguishing feature. By this amendment the Institute established a Committee on Science and the Arts, to be composed of forty-five members of the Institute, to be chosen at the annual election (fifteen each year), and "who shall pledge themselves by their acceptance of membership to perform such duties as may devolve upon them, and to sustain by their labors the scientific character of the Institute."

Some years later the membership of the committee was increased from forty-five to sixty and by a provision recently adopted the members are elected by the Board of Managers, twenty each year.

During the past twenty-five years the committee has investigated nearly 1,000 discoveries, processes, and inventions.

THE JOURNAL

The publication of a journal for the diffusion of knowledge on all subjects connected with science and the useful arts, was embraced in the plan of the founders, and was undertaken shortly after the organization had been effected. This publication has been continued without interruption to the present time, and has proved most useful, not only in directly promoting the aims and objects of the Institute, but also in extending the sphere of its influence beyond the limits of its local habitation.

The first step to secure a publication was taken by the Institute as early as 1825, when, by arrangement with C. S. Williams, publisher, a magazine bearing the title *The American Mechanics' Magazine*, and which had been founded by him in New York at the beginning of that year, was acquired by Dr. Thomas P. Jones, who had recently been elected professor of mechanics in The Franklin Institute. At the outset the responsibility of this venture appears to have been assumed by Dr. Jones, after he had received assurances of active co-operation and support from the members of the Institute, who were warmly interested in its success.

The prospectus of the new publication, which was issued August 1, 1825, announced the fact that "shortly will be published

THE
FRANKLIN JOURNAL
AND
MECHANICS' MAGAZINE,

UNDER THE PATRONAGE OF

THE FRANKLIN INSTITUTE, OF THE STATE OF PENNSYLVANIA, FOR THE PROMOTION OF THE
MECHANIC ARTS, EDITED BY DR. THOMAS P. JONES, PROFESSOR OF
MECHANICS IN THE INSTITUTE."

The object of *The Franklin Journal*, as defined in the prospectus, was, "to diffuse information on every subject connected with useful arts."

In the prospectus of *The Franklin Journal* attention is called to the fact that it was intended to give a list of patented inventions, with remarks upon their utility and originality. This proposition was literally maintained and continued as a prominent feature of the JOURNAL to the close of 1859, save that the "Remarks," which were in many cases of the greatest value to those interested in the progress of the arts and manufactures, were discontinued on the death of Dr. Jones. His accession to the position of Superintendent of the Patent Office naturally caused him to devote special attention to the preservation of the record of patents in the pages of the JOURNAL. This circumstance has since proved of considerable value to all who have need to refer to the early patents of the United States, as will appear from the following explanation:

In the official Patent Office publications, issued by the Government prior to the year 1843, the publication of the claims was omitted; while, for a considerable period, the JOURNAL published an abstract of the specifications and the claims in full. The JOURNAL, consequently, is the only source at present available for reference to the specifications and claims of patents issued by the United States, from 1828 to 1842, inclusive. The JOURNAL can also be used, in place of the official publications, as a source of reference to the patents granted during the period 1826-1859 in which the patent lists were published therein.

The complete file of the JOURNAL embraces *The Franklin Journal*, 1826-1827, and the JOURNAL OF THE FRANKLIN INSTITUTE, 1828 to the present time, 196 volumes in all, with a General Index, 1826 to 1885, and three decennial volumes covering the years 1886 to 1915, inclusive.

In its present form, the JOURNAL is an octavo of over 150 pages. It is published monthly, the twelve impressions being divided into two volumes yearly—January to June and July to December, each separately paged, and supplied with title-page and index.

INSTRUCTION

The first Board of Managers of the Institute provided for the establishment of a standing Committee on Instruction, charged with the duty of directing its educational work.

This committee was appointed on March 4, 1824 and speedily perfected plans for systematic instruction by means of lectures and demonstrations. Professorships in chemistry, in natural philosophy and mechanics, and in architecture were established and filled by the election of capable instructors.

Provision was next made for the instruction of mechanics and apprentices and those engaged in the useful trades, and early in the fall of 1824 a school of mechanical and architectural drawing was established. This experiment seems to have been crowned with complete success; and the managers proceeded to establish another school, in which should be taught "all the useful branches of English literature and the ancient and modern languages. This project was realized in 1826. In 1827 over three hundred scholars were upon its roll. It was the model upon which the Central High School, shortly afterwards established by the city as part of the public school system, was patterned. The drawing school was continued, and maintained an uninterrupted existence for ninety-nine years. Its leading feature—that of training pupils for actual work in shop and office—was always rigorously preserved.

Twenty-five years ago classes in mathematics were established; these later became a part of the school of machine design. Instruction in naval architecture was first given in October, 1899.

All departments of instruction were united in the year 1910 and known as the School of Mechanic Arts.

For a period of ninety-nine years the Institute afforded educational training of a high order to many thousands of young men who, judging by many notable successes, benefited greatly by such training. The educational function of the Federal Government, State and City having been extended to cover fully the Institute's field of effort in vocational training, the work of its School has been suspended.

LECTURES

These have always occupied a prominent place in the scheme of the Institute's work, from the beginning to the present.

The first course was given in the old Academy Building, on Fourth Street, near Arch, owned by the University of Pennsylvania, the use of which for this purpose was granted by the trustees; and the work of the professors was ably supplemented by a corps of volunteer lecturers from the membership of the Institute. A little later, the Institute rented the lower floor of the old Carpenters' Hall for this purpose, and finally, on the completion and occupancy of the hall, the lectures were held in its own lecture room.

For many years the lectures were of the nature of regular courses on architecture, mechanics, physics, and chemistry, varied of course from year to year, but following generally the plan of graded or consecutive instruction, as in schools and colleges. This system, however, though for a long period admirably useful in meeting the needs of the public, was found in time to be gradually outgrowing its usefulness. Lecture courses on scientific themes, which for years had been practically pre-empted by The Franklin Institute,

in time were made attractive features in the schools and colleges, and the popular science lecturer became a conspicuous figure on the public lecture platform. And so it came about, naturally, that the Committee on Instruction found it advantageous gradually to modify its plans to adapt them to the changes of the times. For a number of years, accordingly, the character of the Institute lectures has departed widely from the old-time pattern. The object at present most conspicuously kept in view in the selection of the lectures is to give the members of the Institute the advantage of having presented to them the latest advances in the useful arts and the sciences bearing thereon; and, to this end, the committee's efforts each year are directed to the purpose of securing the services of men of eminence in their respective fields of labor, who are invited to select their own themes. Since its foundation, The Franklin Institute has given free to the public thousands of lectures by distinguished scientists and technologists on scientific and technological subjects in addition to numerous popular and illustrated addresses on subjects of immediate interest to the public and germane to the topics of the day.

MEETINGS

General meetings of the Institute's entire membership are held once each month, except during the summer. At these meetings great inventions and discoveries, important engineering projects, and notable achievements in all fields of scientific progress are presented, exhibited or discussed. Many of the epoch-making inventions have been shown in their experimental stages at these meetings—as the phonograph, the electric light, the typewriter, liquid air apparatus, machine telegraphy, etc.

EXHIBITIONS

As a means of promoting the mechanic arts, the holding of exhibitions was highly favored by the founders, and in this field of activity the Institute, for many years, was conspicuously prominent.

The first exhibition of American manufactures was held in October, 1824, in Carpenters' Hall.

This, it should be remembered to the credit of the Institute, was the first of the kind to be undertaken in this country.

The exhibitions of the Institute were held yearly or biennially, down to the year 1858. Many of the earlier events took place in the old Masonic Hall, on Chestnut Street, above Seventh, and in a temporary annex thereto; and the more recent ones in the one-time famous Museum Building, at Ninth and Sansom Streets, the destruction of which by fire, in the year 1850, made it necessary for the managers, for several years, to adapt themselves to less desirable quarters, and finally to discontinue the exhibitions for a time for want of a centrally located building suitable for the purpose.

In the year 1874 occurred the fiftieth anniversary of The Franklin Institute, and a fortunate circumstance enabled the managers to signalize the event by holding an exhibition, which proved from every point of view an

eminently successful one. The circumstance spoken of was the fact that the Pennsylvania Railroad Company placed at the service of the Institute, for exhibition purposes, the old building at Thirteenth and Market Streets, for many years occupied as a freight station. Over 268,000 visitors attended this exhibition.

Successful, however, as was the exhibition of 1874, it was eclipsed in brilliancy, and in value from the educational and technical standpoint, by that of 1884, which will ever be memorable in the annals of The Franklin Institute. This was the Electrical Exhibition, held in the autumn of that year, under the direction of the Institute, and which by Act of Congress, approved February 26, 1883, was made international in character. It was the first exhibition in America devoted exclusively to the electrical arts.

In 1885 the Novelties Exhibition was held in the building erected for the electrical exhibition.

No further exhibitions have been held since that time, though the Institute co-operated with the Commercial Museum of Philadelphia in the management of the National Export Exposition of 1899.

MODELS AND HISTORICAL APPARATUS

This collection includes the electrical machine used by Dr. Franklin in his experiments in Philadelphia, his imposing stone and table for dressing type; Dr. Priestley's air pump, brought by him to America in 1794; odometre used by Dr. Franklin when postmaster general of the colonies and by Thomas Jefferson; George M. Phelps' printing telegraph apparatus; magneto-electric machine made by Joseph Saxton and exhibited by him at the meeting of the British Association for the Advancement of Science in 1833; Oertling balance made about 1840; model of Oliver Evans' first high-pressure steam engine, made by Rush and Muhlenberg; model of George Stephenson's "No. 1." locomotive built for the Stockton and Darlington Railroad.

There are also numerous examples of metering devices for water, air, gas and electricity; photographic apparatus; typing and calculating machines and philosophical apparatus, the whole illustrative of the genius for discovery and invention that have made the past century notable in the history of science and its application in the industries.

HISTORICAL EXTRACTS

(CHRONOLOGICALLY STATED)

One century ago there lived in Philadelphia two young men who independently conceived the idea of founding an American institution for promoting knowledge of physical science and its diffusion in the arts and industries. One of them was Samuel V. Merrick, then not quite twenty-one years old, and the other was Prof. William H. Keating of the University of Pennsylvania.

Mr. Merrick issued several calls for meetings for the consideration of the project, but no one attended.

Prof. Keating had completed his scientific training in France and Switzerland and had returned to the United States full of zeal for the diffusion of science applied to agriculture and the mechanic arts. He was immediately appointed to the newly created chair of Chemistry in its application to Agriculture and the Mechanic Arts, at the University of Pennsylvania and while thus engaged sought to interest his friends and others in his plans for a scientific and technical society. Mr. Merrick and Prof. Keating comparing notes agreed to make another effort to hold another meeting for purposes they both had in mind.

Six gentlemen attended this meeting and a committee was appointed to draft a plan of organization, constitution, etc.

A small meeting was held, a plan approved, and Mr. Merrick and Prof. Keating set about to carry it into execution.

Four of the Committee selected from 1,200 to 1,600 names of citizens from the City Directory and invited them to attend another meeting to be held at the County court house at Sixth and Chestnut Streets, Philadelphia, on the evening of February 5, 1824.

The court house was filled to overflowing and from this meeting dates the founding of The Franklin Institute.

1824, February 5. First public meeting held in the County Courthouse, Sixth and Chestnut Streets for the purpose of organizing The Franklin Institute. A constitution was adopted and a day fixed for the election of officers.

February 16. First Election of officers, James Ronaldson elected president.

March 4. Committee on Lectures appointed and the Chair of Mineralogy and Chemistry established.

March 30. An act to incorporate The Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts passed by the Legislature and signed by the Governor.

Dr. William H. Keating, Professor of Mineralogy and Chemistry delivered the first lecture of the first course in the Academy Building, Fourth Street, below Arch, in April.

A Drawing School for members' sons and apprentices was opened in October. John Haviland, professor in charge, assisted by Hugh Bridport, artist and painter of miniatures.

October 18, 19 and 20, first exhibition of products of American industry held in Carpenters' Hall. Thirty premiums were offered for specimens of blister steel, bar iron, broadcloths, domestic carpetings, etc. Three hundred exhibits; ten silver medals and two bronze medals were awarded.

1825, April 4. A Mathematical School for members, their sons' and apprentices was opened under the direction of Mr. Levi Fletcher.

June 8. This day at high 12 o'clock The Corner Stone of the Hall of The Franklin Institute was laid in ancient and Masonic form by the Grand Lodge of Pennsylvania in the presence of the Society. After the appropriate ceremonies had been performed by the Grand Master, prayers were offered up by the Revd. C. G. Potts, Grand Chaplain. The Grand Treasurer deposited in the cavity of the Stone, a glass cylinder hermetically sealed containing:

The constitution and by-laws of The Franklin Institute with their first annual report and list of Members, etc.

Medal of William Penn and the Indian chief, sitting under a tree smoking the calumet of peace, on the reverse the allseeing eye, inscribed "Let us look to the Most high, who blessed our fathers with peace."

Head of Washington inscribed "George Washington: Commission resigned—Presidency relinquished—1797."

A Silver Medal, with the head of James Munroe, Late President of the United States. On reverse: The Hands of an American officer and an Indian Chief grasped, under the Calumet of Peace. Motto: "Peace and Friendship."

3 Coins of the United States 1825.

A parchment Scroll on which was inscribed the following:

On the 8th day of June 1825 A. D. 5825 A L and of the independence of these United States the forty-ninth—this Corner Stone of the Hall of The Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts was laid in Ancient and Masonic Form by the Grand Lodge of Pennsylvania.

James Harper, Jr., R. W. G. M.

Thomas Kittera, R. W. D. G. M.

Samuel Badger, R. W. S. G. W.

Michael Nesbit, R. W. J. G. W.

Samuel H. Thomas, R. W. G. S.

Robert Toland, R. W. G. T.

The Franklin Institute was founded the 5th day of February, A. D. 1824 and incorporated the 30th day of March, 1824.

Names of the officers of the year 1825:

President, James Ronaldson.

Vice-presidents, Math. Carey, I. Lukens.

Recording Secretary, W. Strickland; Corresponding Secretary, P. A. Browne.

Treasurer, Thos. Fletcher.

Managers, Paul Beck, Jr., Jno. Harrison, Saml. R. Wood, William H. Keating, Jno. Haviland, Samuel V. Merrick, William Abbot, Jno. D. Eisenhut, Jno. P. Wetheril, James Clarke, Abm. Miller, Jas. Harper, Jr., Adam Ramage, Harvey Lewis, R. M. Patterson, James McAlpin, Wm. Fry, Wm. Kneass, Joseph Donaldson, J. B. Garrigues, Wm. S. Warder, Lloyd Miflin, A. G. Ralston.

Building Committee of the Hall:

Peter A. Browne, S. R. Wood, S. V. Merrick, James McAlpin, J. B. Garrigues.

Architect, Jno. Haviland.

M. Carpenter, Jas. Clarke.

M. Marble Mason, John Struthers.

M. Bricklayer, Daniel Groves.

The assembly was then addressed by P. A. Browne, Esq. and Adjourned.

(From the minutes of The Franklin Institute, vol. A.)

Dr. Thomas P. Jones appointed Professor of Mechanics and Natural Philosophy.

October 6, 7 and 8, second exhibition of American manufactures held in Masonic Hall, Chestnut Street, west of Seventh. The number of articles exhibited far exceeded that of the previous year. Eighty-five premiums were offered. Six hundred and ninety-nine articles are listed in the catalogue of exhibits.

1826, January. First number of THE FRANKLIN JOURNAL was issued under the editorial management of Dr. Thomas P. Jones. In addition to his position as Editor, Dr. Jones also acted as Recording Secretary of the Institute and Curator of its collections. April 12, 1828 he was appointed Superintendent of the U. S. Patent Office.

It extended its educational efforts by establishing on April 6 a High School in which Mathematics, Drawing, Geography, History, Latin, Greek, French, Spanish and German were taught. 304 pupils were in attendance in October, 300 were studying English, 153 French, 105 Latin, 35 Greek, 45 Spanish, 20 German, 300 Elocution, 240 Geography, 231 Drawing and all of them Mathematics. The School was continued until 1832 and was the predecessor of the Central High School.

October 3, 4, 5, 6, third exhibition of American manufactures was held in Masonic Hall. Silver medals were awarded for soft iron castings, flint glass ware, china from American materials, skirting and japanned leather, white lead, etc. 34,000 visitors.

1827. Select Committee on Dry Docks made a lengthy illustrated report on the plans submitted by Commodore James Barron, U. S. N., and Captain Thomas Caldwell, giving costs, methods of operation, etc.

October 4, 5, 6 and 8, fourth exhibition of American manufactures held in Masonic Hall. Sixty-two premiums were offered. John L. Wilson, a pupil of the High School of The Franklin Institute, was awarded a silver medal for his map of South America which was exhibited at that time.

1828, October 8, 9, 10 and 11, fifth annual exhibition of American manufactures held in Masonic Hall. Forty-five premiums were offered. Awards were made for specimens of annealed cast iron (the first attempt in this country to anneal iron for general purposes), for the best porcelain made in the United States, for calicos or prints, etc. Robert P. Warner, a pupil of the High School, was awarded a silver medal for his drawing of an air pump.

1829. Committee appointed to investigate the efficiency of moving water as a motive power. The report of the Committee, containing much information, and the results obtained from seven hundred experiments, the effect of each of which was submitted to minute calculation, appeared in the *JOURNAL* of the Institute for 1831 and 1832. The second portion of the report dealing chiefly with overshot wheels, undershot wheels, and breast wheels was published in March, April, May, June and July, 1841.

1830, September 14 to 19 inclusive, sixth exhibition of American manufactures held in Masonic Hall. The exhibition distinguished itself from all preceding ones by the great excellence of the articles deposited. Thirty-seven premiums were proposed, but three only were adjudged to be due; the first for the best stock or standing vice, the second for a cooking stove, and the third to the maker of a vegetable oil that would answer as a substitute for olive oil. The exhibit of American silk was most noteworthy.

Because of the numerous accidents in steam boats, a committee of five members was appointed to inquire and report whether it be expedient for the Board to institute an investigation into the probable causes of these accidents and the proper remedy to be applied to prevent their recurrence. The appointment of a large committee was suggested to inquire into the probable causes of the explosions of boilers, the best way to obviate the recurrence of these evils, and to limit the extent of their injurious influence. Seventeen members were appointed to undertake this investigation, including Dr. Thomas P. Jones, Professor Walter R. Johnson, Matthias W. Baldwin Frederick Graff and Isaiah Lukens. While the work of the Committee was still in progress, the Secretary of the Treasury of the United States requested that further extension of the Institute's inquiry include the prevention of steam boiler explosions. This led naturally to an investigation of the strength of materials, and the Committee devised apparatus of various forms for the testing of metals, building materials, steam boilers, etc. The correspondence and documents collected by the Committee with its extensive report appeared in the issues of the *JOURNAL* of the Institute for 1831, 1832, 1833 and 1834. The report of experiments on the prevention of boiler explosions was published in January, February, March, April and May 1836, and the

results of the investigations on the strength of materials with numerous illustrations and detailed descriptions of original apparatus appeared in the *JOURNAL* February to August 1837.

1831, October 4 to 8 inclusive, seventh exhibition of domestic manufactures held in Masonic Hall. Visitors exceeded forty thousand. Eighty-nine premiums were proposed of which fifteen were adjudged due. Fifteen additional premiums were recommended. A silver medal and one hundred dollars were awarded for a cast iron cooking stove for anthracite coal. Five hundred and forty-two articles were exhibited.

1832. Commenced an investigation into the resources of the Commonwealth considered in relation to its industry and manufactures, an occasion which led to a geological survey of the State.

Walter R. Johnson presented a notable communication on "The Strength of Cylindrical Steam Boilers." The results given are based on the extensive series of experiments made by the Institute's Committee on the Explosion of Steam Boilers.

1833. The Institute was requested by the State Legislature to examine and report upon a bill relating to weights and measures and admeasurement reported to the House of Representatives June 26, 1833. A special committee of seventeen was appointed to consider the matter. The extensive report which included a detailed statement on the weights and measures of France, England and the United States, as well as an authentication of the Troy pound used in the United States Mint, appeared in the *JOURNAL* for November, 1833 and February to July inclusive, 1834. The Governor requested the Committee to superintend the construction of the Standards.

The present laws of the state are based on the recommendations made as a result of this investigation.

October 1 to 5 inclusive, eighth exhibition of domestic manufactures held in Masonic Hall. Over seven hundred exhibits. Fifty thousand visitors. Silver medals were awarded for lamps, pianos, rifles, hardware, carpets, cotton and woolen goods, etc.

1834. Joint committee of The Franklin Institute and the American Philosophical Society first began systematic meteorological observations in aid of agricultural and other interests. A circular issued by the Committee requested observers to note the direction of the wind; to collect all information concerning storms—their width, direction, velocity, etc.; and the beginning and end of all rains. Detailed instructions were given for taking the "dew point." The Committee consisted of eight members, three from the American Philosophical Society and five from The Franklin Institute, Dr. James P. Espy acting as Chairman. This Committee continued its work successfully until 1838 when that portion appointed by the Philosophical Society were discharged by that body and the Board of Managers at once appointed a standing Committee on Meteorology to continue the collection of the data. By an Act of the Legislature, passed March 31, 1837, two thousand dollars were appropriated with the further sum of one thousand dollars for each of the two years next ensuing, for the purpose of promoting

the improvement of meteorological science, and the furnishing of each county of this commonwealth with the necessary instruments for the observation of such atmospheric changes and phenomena as may be useful for the promotion of knowledge in the science of meteorology.

1835, October 7 to 10 inclusive, ninth exhibition of domestic manufactures held in Masonic Hall. Awards were made for samples of muslin, chintz prints, gingham, venetian carpeting, straw bonnets, watch dials, water and oil colors, pearl work, leather, porcelain, etc.

1837. The general interest created by the Institute's work gave rise to a movement for the establishment of a school of arts, and a public lot for the erection of buildings was offered by City Councils on High (Market) Street, west of the Schuylkill River. An application for an appropriation from the State failed to pass the Legislature, and after further consideration by the Institute's Committee it was found inexpedient to organize any school at this time, and the plan was abandoned. The movement resulted later in the founding of the Department of Science of the University of Pennsylvania.

1838, November 6 to 17 inclusive, tenth exhibition of domestic manufactures held in Masonic Hall. The profits to the Institute on the present occasion were greater than was ever before realized, notwithstanding the heavy expenses incurred in making preparations. Awards were made for cotton and woolen goods, silks, straw goods, specimens of iron and steel, cutlery, philosophical apparatus, harness, etc. A chandelier with thirty-eight lights made for the Senate Chamber of the State of Mississippi was one of the striking exhibits.

1839. The JOURNAL for November, 1839 contained a full translation by Professor John F. Frazer of the paper "Practical Description of the Process Called the Daguerreotype, which Consists in the Spontaneous Reproduction of the Images of Natural Objects in the Camera Obscura, not with Their Colours, but with Great Delicacy in the Gradation of Tints" presented to the French Academy by Daguerre.

1840. A detailed review of Dr. Alexander Dallas Bache's report on education in Europe to the Trustees of Girard College for Orphans appeared in the JOURNAL for January, (the report, covering nearly seven hundred pages, was made for use in connection with the organization of Girard College, of which Dr. Bache was President).

October 7 to 21 inclusive, eleventh exhibition of domestic manufactures held in Masonic Hall. Silver medals were awarded for cotton and woolen goods, specimens of iron and steel, hardware and cutlery, a cooking stove, a piano, wall paper, etc. Over one thousand exhibits.

1842. Samuel V. Merrick elected president of the Institute.

October 18 to 31 inclusive, twelfth exhibition of American manufactures held in the Philadelphia Museum Building, northeast corner of Ninth and Sansom Street and Welch's Olympic Circus, Walnut Street west of Eighth. No exhibition passed this in point of quality. About nine hundred exhibits.

1843. A request from City Councils for information on the best modes of paving highways. This question was referred to the Committee on Science

and the Arts and a subcommittee of eight members was at once appointed. A voluminous report was presented, which gave careful consideration to all phases of the subject. The best construction of asphalt, wood and stone pavements was described. Pavements especially suitable to Philadelphia were noted, as well as plans and specifications, and superintendence and manner of executing the work. The report was accompanied by a map of Philadelphia showing the soils and drainage between the Delaware River and the Schuylkill River, and South Street on the South and Vine Street on the North.

October 17 to 28 inclusive, thirteenth exhibition of American manufactures held in the Philadelphia Museum Building. Silver medals were awarded for printed cotton goods, longcloths, gentlemen's boots and slippers, artificial teeth, etc.

1844, October 14 to 30, fourteenth exhibition of American manufactures held in the Philadelphia Museum Building. Fifty-nine silver medals were awarded for cotton and woolen goods, hardware and cutlery, glassware, etc. and one hundred and fifty-four certificates of Honorable Mention.

1845, October 21 to November 1 inclusive, fifteenth exhibition of American manufactures held in the Philadelphia Museum Building. Fifty-one first-class premiums were recommended, two hundred and sixteen awards in all. Seventy thousand visitors.

1846, October 20 to 31 inclusive, sixteenth exhibition held in the Philadelphia Museum Building. Silver medals were awarded for gloves, specimens of rolled iron, lamps and gas fixtures, wire rope, coach harness, window shades, musical instruments, etc.

1847, October 19 to 30 inclusive, seventeenth exhibition of American manufactures held in the Philadelphia Museum Building. Silver medals were awarded for blankets, shawls, woolen and worsted yarn, bars of iron, the chandelier made for the Opera House at New York, machinery, glassware, book binders' dies, chemicals, etc. Seventeen hundred and forty-two exhibits.

1848, October 17 to 28 inclusive, eighteenth exhibition of American manufactures held in the Philadelphia Museum Building. Silver medals were awarded for cotton and woolen goods, carpets, specimens of iron, lamps and gas fixtures, hardware, glassware, furs, chemicals, etc. A first premium was awarded for a copy of the Webster dictionary, designed as a present to the Queen of England. Seventeen hundred and fifty-one exhibits.

1849, October 16 to 27 inclusive, nineteenth exhibition of American manufactures, held in the Philadelphia Museum Building. Silver medals were again awarded for products made from cotton and woolen materials, hardware and cutlery, also for Daguerreotypes, Talbotypes and Hyalotypes, boots and shoes, chemicals, needlework, etc.

1850. The School of Design for Women was founded by the Institute, Mrs. Sarah Worthington Peter, first Directress. Classes in art and design for women had been conducted by Mrs. Peter in her home, Number 327 South Third Street for six years prior to the establishment of the School by the Institute.

In 1851 a room was leased at Number 70 Walnut Street (West of Third), where the School began as an independent institution under the direction of a special committee appointed by the Board of Managers of the Institute. This arrangement continued for two years when, in the spring of 1853, control was transferred to a separate organization, and Elliott Cresson, one of the Institute's benefactors, became the President.

October 15 to 26 inclusive, twentieth exhibition of American manufactures held in the Philadelphia Museum Building. Silver medals were awarded for tin-ware, dental materials, chemicals, leather, saddlery and harness, philosophical instruments, etc. Nine hundred and fifty exhibits.

1851, October 21 to November 1, twenty-first exhibition of American manufactures held in the Philadelphia Museum Building. Awards were made for agricultural implements, carpetings, hardware, cabinet ware, lamps and gas fixtures, leather, chemicals, etc.

1852, October 19 to 30 inclusive, twenty-second exhibition of American manufactures held in the Philadelphia Museum Building. One special award, four gold medals, five recall first premiums (silver medals), eighty-six first premiums, fifty-two second premiums and thirty-eight third premiums were awarded. Ten exhibits were referred to the Committee on Science and the Arts. Twelve hundred exhibitors, one hundred thousand visitors. In number of exhibitors and articles displayed, as well as their beauty, novelty and value this exhibition was superior to any previous one held by the Institute.

1853, October 18 to November 3 inclusive, twenty-third exhibition of American manufactures held in the Philadelphia Museum Building. One hundred and eighty-six awards were made. Over eight hundred exhibits.

1854, November 14 to December 2, inclusive, twenty-fourth exhibition of American manufactures held in Dr. David Jayne's granite building on Dock Street. Premiums were offered for perfumery and soaps, straw goods, chemicals, furs, saddlery and harness, leather, dental materials, surgical instruments.

1855. John C. Cresson elected president of the Institute.

1856, November 11 to 29 inclusive, twenty-fifth exhibition of American manufactures held in Dr. Jayne's building on Dock Street. Silver medals were awarded for specimens of rolled iron, hardware, stoves and heaters, cabinet-ware, lamps and gas fixtures, silverware and jewelry, cotton and woolen goods, chemicals, etc. 1226 exhibits.

1858, October 15 to November 13, twenty-sixth annual exhibition of American manufactures held in the State Armory Building and adjacent grounds (Sixteenth and Filbert Streets). Awards were made for musical instruments, books, stationery, printers' type and materials, boots and shoes, needlework, coachwork, dental materials, philosophical apparatus, glass and china, lamps and gas fixtures, machinery, etc. A special pamphlet report on the sewing machines deposited at this exhibition was published in 1859.

1863. The Guardians of the Poor requested the Institute to communicate to them the most efficient means of protecting the Alms House Buildings from lightning.

A subcommittee of the Committee on Science and the Arts, to whom the problem was referred, made a survey of the grounds and buildings and recommended the installation of a system of lightning rods, properly connected and grounded. Detailed directions were given for making this installation.

1864. William Sellers elected president of the Institute.

At the Stated Meeting of the Institute held April 21, 1864, President William Sellers read a paper on a System of Screw Threads and Nuts. He pointed out the importance of a uniform system of screw threads, bolt-heads and nuts and offered suggestions for establishing such a system. Tables, diagrams and formulae were submitted and comparisons were made with the English system. After a discussion it was voted to send copies of Mr. Seller's paper to other societies for consideration and approval. A special committee was appointed to investigate the question of a proper system of screw threads, bolt-heads and nuts, to be recommended by the Institute, for the general adoption by American engineers. The committee presented its report in December and recommended the adoption of certain forms and proportions. Copies of the report and resolutions were forwarded to the various departments of the United States Government and to the Superintendents and Master Mechanics of railroad companies requesting them to use their influence to promote the adoption of a uniform system of screw threads, bolt-heads, and nuts, by requiring all builders under any new contracts to conform to the proportions recommended. Copies were also sent to Mechanical and Engineering Associations and Institutions, machine and engine shops throughout the country with a request that they use their influence in favor of the proposed system. The Sellers or Franklin Institute system was adopted by the United States Government in 1868, in the following year the Pennsylvania Railroad Company ordered a set of gauges of the new form and adopted it and in 1872 the Master Car Builders' Association recommended the system as a standard.

1865. Dr. Henry Morton elected first Resident Secretary of the Institute.

1867. J. Vaughan Merrick elected president of the Institute.

1869. Organized the Expedition to observe the Solar Eclipse at Mount Pleasant, Iowa, on August seventh. A party of volunteers, twenty in number, under the direction of Henry Morton attended to the various duties in connection with the observation. The telescopes were borrowed and the transportation for the party and equipment was furnished by the railroad companies. The first account of the work of the members of this expedition appears in the *JOURNAL* of the Institute for September, 1869. (Vol. 88, p. 200.)

A committee of three was appointed to consider the subject of memorializing Congress in reference to an exposition of Arts and Manufactures on the centennial anniversary of American Independence, to be held in the city of Philadelphia. This action resulted in the appointment of a special committee of five to bring the matter to the attention of Select and Common Councils and request that they memorialize Congress on the subject.

A joint committee was organized, consisting of nine members from each chamber of Councils, three members from each House of the Legislature, and five representatives of the Institute, for the purpose of obtaining such aid as would make such an exhibition truly international in its character.

The efforts of this Committee resulted in the passage, by Congress, on March 3, 1871, of An Act to Provide for celebrating the 100th Anniversary of American Independence by holding an international Exhibition of Arts, Manufactures and Products of the Soil and Mine in the City of Philadelphia, and the State of Pennsylvania in the year 1876.

1870. Dr. Coleman Sellers elected president of the Institute.

1871. Dr. William H. Wahl elected Secretary of the Institute.

The Committee appointed June 21, 1871, to examine into the modes of determining the horse-power of steam boilers presented a preliminary report which appeared in the *JOURNAL* for August 1871. The concluding report was published in August 1872 and was fully discussed at the Stated Meeting of the Institute held in October 1872 (*J. F. I.*, December 1872, vol. 94, p. 377). It was voted to increase the membership of the Committee having charge of the experiments and have the investigation continued. A majority and minority report were presented to the Stated Meeting of the Institute on November 19, 1873 and appear in the *JOURNAL* for December 1873. (Vol. 96, p. 396.)

1873. At the Stated Meeting of the Institute held February 19, 1873, the suggestions made by Professor J. P. Lesley in a letter to the Governor of Pennsylvania dated February 1 (*J. F. I.*, Vol. 95, p. 194) urging the establishment of a geological survey of the state were approved. In his letter Professor Lesley called attention to the needs and advantages of a survey, the importance of accurate geological maps of the state and submitted suggestions for a complete working corps for the operations of the various departments of the survey. He estimated that the annual expense for personnel, laboratory, traveling expenses, instruments, publications and printing would be \$47,000.

On May 14, 1874 the Legislature passed a bill providing for a state survey which was signed by the Governor on the same day. The bill included an appropriation of \$35,000 per year for three years. (This was the beginning of the Second Geological Survey of Pennsylvania.)

The April issue of the *JOURNAL* contains a report of the Committee on the Causes of Conflagrations and the Methods of their Prevention, with an exhaustive paper on "The Light Petroleum Oils; considered as to their safety or danger, in various domestic uses" prepared by Dr. William H. Wahl for the use of the Committee.

At the Stated Meeting of the Institute held March 19, 1873 it was resolved, to recommend and petition the legislature to pass an act or acts embodying the following points: To appoint a competent commission to investigate and determine some satisfactory test whereby it can be ascertained which oils or compounds are safe to be used in lamps and which are unsafe. To make it a penal offence to manufacture, compound, sell or

knowingly use any oil or compound that will not stand the required test, and that in case of death resulting from the same, the guilty person or persons shall be liable to conviction for manslaughter.

1874, October 6 to November 12 inclusive, twenty-seventh exhibition of American manufactures held in the Pennsylvania Railroad Station, Thirteenth and Market Streets, Philadelphia (site of the Wanamaker Store). Held to celebrate the fiftieth year of the founding of the Institute. Number of exhibitors—twelve hundred and fifty-one, paid admissions—two hundred and sixty-seven thousand six hundred and thirty-eight. Two hundred and one silver medals, two hundred and twenty-eight bronze medals and two hundred and twenty-two certificates of Honorable Mention were awarded, 1875. Dr. Robert E. Rogers elected president of the Institute.

J. B. Knight elected Secretary of the Institute.

An ordinance passed by Councils June 5 requested the Mayor to appoint a Commission of five scientific and practical engineers to be selected from not less than eight names recommended by the Board of Managers of The Franklin Institute, to whom, in connection with the Chief Engineer of the Water Department, shall be referred the entire subject of the present and future water supply of Philadelphia. The Commission organized on June 29 and made a thorough investigation of the various pumping stations and reservoirs. Special examinations were made of the Wissahickon valley, the valley of the Perkiomen, the upper Schuylkill River and the Delaware River above tide, particularly at New Hope, Easton and the Water Gap. The report of the Commission was presented to Councils before the close of the year and contained nine recommendations for the improvement of the present water supply and special provisions for the Centennial year. For future supply the Perkiomen reservoir and conduit seemed to be reasonably practicable. Abstracts of the Commission's report appear in the JOURNAL for November and December, 1875 (Vol. 100, pp. 292, 368).

In September the Board of Managers learned of the measures being taken to establish a Museum of Industrial Art similar to the South Kensington Museum London and gave the movement their endorsement. In December an invitation was extended to the Institute to choose one of the trustees of the Museum, and in January of the following year Mr. J. B. Knight, then Secretary of the Institute, was chosen to act in that capacity. For ten years the Institute had a voice in the management of the Museum.

1879. William P. Tatham elected president of the Institute.

Dr. Isaac Norris elected secretary of the Institute.

1882. Dr. William H. Wahl elected secretary of the Institute.

A resolution passed at the meeting of the Institute held May 7, requested the President to appoint a committee to give expression of the views of the Institute concerning the pollution of the waters of the Schuylkill River from the entrance of sewage near the Eastern end of the Girard Avenue bridge. The report of the Committee appears in the issue of the JOURNAL for August, 1882 (Vol. 114, p. 135). Attention is called to the advantage which would arise to the general health of the city from the construction of an

intercepting sewer along the eastern banks of the Schuylkill from Manayunk or beyond, and with an outlet sufficiently below the densely populated portions of the City as not to be objectionable.

In conformity with an ordinance passed June 7, the Mayor appointed a Board of Experts consisting of one civil engineer, one mechanical engineer and one hydraulic engineer selected from nine names submitted by the American Society of Civil Engineers and the Institute, and the Chief Engineer of the water department to "report to Councils the methods pursued in the Water Department, together with their recommendations of what should be done for the present and future supply of the City, with such itemized estimates as will enable the cost to be determined." The preliminary report of this Commission was presented to Councils on October 14, 1882, and appeared in the *JOURNAL* of the Institute for April 1883. It contained recommendations for the installation of machinery and apparatus in the several pumping stations, the completion and extension of reservoirs and the management of the stations. The final report was transmitted to Councils on April 5, 1883 (*J. F. I.*, Vol. 116, p. 321). Special attention was given to the future supply of the City and the reduction of waste. The use of meters for factories and large public buildings was suggested.

A paper on the Prevention of Fires in Theatres was read at the Stated Meeting held June 21 by Charles J. Hexamer, C. E., (*J. F. I.*, Vol. 114, pp. 125, 211). At the close of the discussion which followed the reading of the paper it was voted to appoint a committee to investigate the subject of the prevention of fires in theatres. The report of this committee was presented to the Stated Meeting of the Institute on April 18, 1883 and printed in the *JOURNAL* for June (Vol. 115, p. 428). It contains much information on theatre fires, the hazards of artificial light, heating apparatus, fireworks, the use of paper wads in guns, the situation of the necessary work shops, paint lofts and spontaneous combustion. Considerable attention is given to the fire-proof drop curtain and after having obtained information from many sources the committee expressed the opinion that woven asbestos cloth is most satisfactory. The report contains thirty-eight recommendations intended to make places of amusement more safe, nearly all of which have since been adopted.

1884, September 2 to October 11. The International Electrical Exhibition, held in the Pennsylvania Railroad Station at 32nd and Market Streets and a building especially erected at the northwest corner of 32nd Street and Lancaster Avenue.

Without Federal or State aid the Institute held the first great electrical exhibition in this country. Total number of paid admissions, 282,779; receipts from sale of tickets, \$98,639.70. 216 exhibitors.

By an act of congress the United States Electrical Commission was created for the purpose of conducting a national conference of electricians. This commission issued invitations to a large number of scientific gentlemen,

both foreign and American, who assembled in conference on September 8 and continued their deliberations for six days.

During and immediately after the exhibition the most complete and extended series of tests attempted to that time were made to determine the characteristics of all the more important types of electrical apparatus and appliances then commercially used. The results of these tests were published in the JOURNAL and in pamphlet form during 1885 and 1886 as the Reports of the Examiners.

The organization of the American Institute of Electrical Engineers this year resulted from the holding of the electrical exhibition and the international conference of electricians.

1885, September 15 to October 31. The Novelties Exhibition held in the buildings erected for the use of the electrical exhibition; this was the twenty-ninth exhibition and was devoted to novelties in American Manufactures. 375 exhibitors.

Awards of medals and diplomas were made for articles of novel or intrinsic merit.

1886. Charles H. Banes elected president of the Institute.

At the Stated Meeting of the Institute held October 20, 1886 it was resolved, that the subject of organizing a State Weather Service be referred to a special committee, to be appointed by the President, with the request to report a plan for the same, if possible, to the Stated Meeting of the Institute in November.

On December 15 the special committee presented its report and recommended immediate organization of a "State Weather Service" with a volunteer force of observers; that the cooperation of railroad, telegraph and telephone companies and newspapers be solicited; that all institutions of learning throughout the state be invited to take an active interest in the collection of meteorological data and the study of the science; that an effort be made to secure an appropriation of \$3,000 from the state, for the purchase of instruments and for the publication of the results of observations in tabulated form.

The offer of the Chief Signal Officer to furnish a member of the Signal Corps to assist in the work was accepted.

An Act to establish a State Weather Service was at once drafted and passed by the Legislature and the first Summary of Meteorological Reports giving the results of observations made in September appeared in October 1887.

The service was in operation until May 1891 when the State discontinued the appropriation.

1887. Joseph M. Wilson elected president of the Institute.

1889. President Joseph M. Wilson at the Stated Meeting of the Institute held November 20 made some remarks upon his observations of trade schools in France and England, having been charged with the task of investigating the organization and mode of operation of such institutions on behalf of the projected school of Mr. A. J. Drexel of Philadelphia.

Mr. Wilson's complete report "On Schools: with particular reference to Trade Schools" appeared in the issues of the JOURNAL February to October inclusive, 1890.

1897. John Birkinbine elected president of the Institute.

The Board of Health of the City of Philadelphia requested the appointment, by The Franklin Institute, of a committee to cooperate with the Board, in considering ways and means for the abatement of the growing evils arising from the increasing use of bituminous coal within the city limits.

At the meeting of the Institute of April 21, 1897, the regular order of business was suspended and the evening was devoted to the consideration of "The Smoke Nuisance and its Regulation." The discussion was introduced by a paper giving a brief historical account of the subject and some data having especial reference to the smoke question as it affects Philadelphia.

The discussion was continued by brief addresses from eleven prominent engineers and the president of the Board of Health.

The discussion was resumed at the meeting of May 19 by ten engineers of note and the president of the Board of Health.

It was the unanimous opinion of those present at the meeting of September 15, that the frequent discharge of dense black smoke from furnaces of stationary boilers is avoidable and should not be permitted in the city and that the emission of smoke from locomotives and furnaces might be greatly reduced if the cooperation of firemen and employers were enlisted with an earnest intention to abate the nuisance. Resolutions to this effect were approved and it was directed that copies be sent to the Mayor, the President of the Board of Health and to the president of Councils. At this meeting descriptions were presented of improved furnaces and automatic stokers. The representatives of five of the leading manufacturers were present and described their apparatus illustrating their remarks with the aid of models and lantern slides.

The discussion was concluded at the meeting of October 20 when ten stokers and furnaces were described.

A detailed account of the above discussion appeared in the issues of the JOURNAL for June, July and December, 1897 and January and February, 1898.

1899. National Export Exposition held in conjunction with the Commercial Museum of Philadelphia.

The seventy-fifth anniversary of the founding of the Institute was observed by a series of conferences and lectures held in the Convention Hall of the exposition on October 2 to 7 inclusive.

1901. A special Committee appointed by the President to consider the advisability and feasibility of the adoption of the metric system in the United States presented its report on February 19, 1902.

The following preambles and resolutions submitted by the Committee were unanimously adopted:

WHEREAS. It is desirable to obtain an international standard of weights and measures, also to simplify and regulate some of our existing standards; and

WHEREAS, The metric system is commendable, not only as a suitable international standard, but also for facility of computation, convenience in memorizing and simplicity of enumeration;

Resolved, That The Franklin Institute approves of any movement which will promote the universal introduction of the metric system with the least confusion and expense.

Resolved, That the national Government should enact such laws as will ensure the adoption of the metric system of weights and measures as the sole standard in its various departments as rapidly as may be consistent with the public service.

The report, discussion and important correspondence on the subject were published in the JOURNAL for June, July and August, 1902.

In order to promote both domestic and foreign commerce the following preambles and resolutions were adopted at the Stated Meeting of the Institute held on December 18:

WHEREAS, Greater and cheaper transportation facilities are essential to the development of our domestic and foreign commerce;

WHEREAS, The limited appropriations made by the National Government are inadequate to meet the requirements of the country, covering only a small percentage of the approved projects;

WHEREAS, The former policy of authorizing the improvement of our waterways by private capital resulted in a marked development without material cost or risk to the general Government;

WHEREAS, Early and economical results may be secured by a partial return to this method in localities where no provision has been made for immediate improvement; therefore, be it

Resolved, That the proper department of the general Government should be empowered to authorize the improvement, by individuals or corporations, of such rivers, harbors, canals or other waterways as are not provided for under the River and Harbor or the "Sundry Civil" Bills, with authority to collect tolls, upon plans and regulations to be approved by the said department; PROVIDED, that no part of the funds for such work shall be drawn from the public treasury of the United States. Also,

WHEREAS, The commercial and industrial interests of the country have attained such magnitude as to require a more systematic organization for their regulation and development;

WHEREAS, A measure known as Senate Bill No. 738 has been introduced into Congress for the purpose of establishing a Department of Commerce and Industries; therefore, be it

Resolved, That the establishment of such a Department of Commerce and Industries has the hearty approval of The Franklin Institute, and its early inauguration is recommended.

1906. At the Stated Meeting of the Institute held September 19 at the conclusion of the reading of a paper on "The Relations of the Government to Our Waterways" by Prof. Lewis M. Haupt, the following preamble and resolutions were unanimously adopted:

WHEREAS, It is the present established policy of the General Government to provide ample facilities for the water-borne commerce of the United States and to emancipate inter-state commerce from the obstructions imposed by tolls or restricted canals under private or corporate control,

WHEREAS. This policy has been successfully inaugurated in all parts of the country with the exception of the early canals skirting the most populous and important cities of the Atlantic seaboard, and

WHEREAS, The best interests of the country demand the early construction of capacious canals connecting the interior waters of the bays and sounds of this coast, for commercial purposes as well as for national defense, and

WHEREAS, The most important and least expensive of these links is the one connecting the waters of the Chesapeake and Delaware Bays by a canal which is less than fourteen miles in length, and which has a trunk of only nine feet in depth and sixty-six feet minimum width, in which the Government is a joint owner, and concerning which its officials and commissions have invariably reported that it is vital for the protection of the coast, as has been demonstrated in our several wars, and

WHEREAS, Congress has again authorized the appointment of a Commission to ascertain the expense of securing control of the works and franchises of the Chesapeake and Delaware Canal with a view to the acquisition of the aforesaid canal as a free and open waterway, which Commission is to report at the coming session of Congress.

Be it therefore *Resolved*, That The Franklin Institute of Pennsylvania reaffirms its position as to the urgent necessity of enlarging our coastwise waterways, and especially the Chesapeake and Delaware Canal for commercial and strategic purposes at the earliest practicable date.

Resolved, That a Committee be appointed to present this resolution to the Commission at the public hearing to be held in this city on the 27th instant.

1907. Dr. Walton Clark elected president of the Institute.

1909. James Christie elected secretary of the Institute.

1910. Dr. Robert B. Owens elected secretary of the Institute and appointed editor of the JOURNAL.

1912. Centenary of the Introduction of Gas as an Illuminant observed on April 18 and 19.

The Institute with the cooperation of the American Philosophical Society, the American Chemical Society and the American Gas Institute arranged a series of meetings and lectures dealing with subjects relating to gas and gas manufacture. An important feature of the celebration was a loan exhibition of models, photographs, sketches, prints, manuscripts and drawings relating to every phase of the gas industry; also specimens of gas meters, lamps and burners, gas stoves and other appliances.

The Board of Associate Editors of the JOURNAL created.

1914. Conducted meeting in Philadelphia on June 3 in commemoration of the thirtieth anniversary of the International Electrical Exhibition.

Addresses were made by Messrs. E. W. Rice, Charles F. Brush and Frank J. Sprague.

1915. First awards of The Franklin Medal.

1916. Format of the JOURNAL changed from 6 x 9 inches to 6½ x 9½ inches with increase in the number of reading pages.

1917. Established and maintained a recruiting and examination station for applicants for admission to the Aviation Service of the United States Army.

Established School of Navigation for the United States Shipping Board.
Conducted free Radio School for men of the selective draft.

1920. Published "Physics of the Air" by W. J. Humphreys, C.E., Ph.D., 665 pages, illustrations, diagrams, octavo.

1921. Received \$1,208,468.32 from the bequest of Henry W. Bartol, a life-member of the Institute, for research. "Bartol Research Foundation" established for the purpose of conducting researches relating to fundamental problems in physical science, particularly those in the field of electricity, and for the investigation of specific problems of a scientific nature which may arise in the industries. Dr. R. B. Owens appointed Director of the Foundation.

1922, March 6 to 10 inclusive. F. W. Aston, M.A., D. Sc., F.R.S., Fellow of Trinity College, Cambridge, England delivered a course of lectures on "Atomic Weights and Isotopes"

1923, April 9 to 13 inclusive. Sir Joseph John Thomson, O.M., F.R.S., LL.D., Ph.D., D.Sc., Master of Trinity College, Cambridge, England, delivered a series of lectures on "The Electron in Chemistry." Subsequently published in book-form, 144 pages, octavo.

1923. Laboratory for conducting the work of the Bartol Research Foundation provided for by the reconditioning of three buildings on the Institute's property at Nineteenth and Cherry Streets.

CHARTER AND BY-LAWS

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS

An Act, to incorporate The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts.

SECTION 1. Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania in General Assembly met, and it is hereby enacted by the authority of the same, That the subscribers to the association called The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, and all such persons as may hereafter be admitted members of the same, shall be, and they are hereby declared to be, a body politic and corporate, by the name and style of "THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS," to have perpetual succession, to sue and be sued, implead and be impleaded, in all courts of record or elsewhere, to use a common seal, and break, alter, and renew the same at pleasure, and to take, hold, and enjoy lands, tenements, and hereditaments; Provided that the yearly income of the real estates held by them shall not exceed two thousand dollars.

SEC. 2. And be it further enacted by the authority aforesaid, That the objects of the said corporation shall be the promotion and encouragement of manufactures and the mechanic and useful arts, by the establishment of popular lectures on the sciences connected with them, by the formation of a cabinet of models and minerals, and a library, by offering premiums on all objects deemed worthy of encouragement, by examining all new inventions submitted to them, and by such other measures as they may judge expedient.

SEC. 3. And be it further enacted by the authority aforesaid, That the members of the said corporation shall consist of manufacturers, mechanics, artisans, and persons friendly to the mechanic arts; they shall pay such sum annually, or in gross, as shall be required by the by-laws of the said corporation for an annual, or life, subscription; Provided that nothing herein contained shall be construed to prevent the said corporation from electing honorary or corresponding members, who may be exempted from such payments and other duties of membership, in such manner and to such extent as may be prescribed by the by-laws of the said corporation.

SEC. 4. And be it further enacted by the authority aforesaid, That the officers of the said corporation shall be a president, two vice-presidents, a recording secretary, a corresponding secretary, a treasurer, and twenty-four managers, who shall, together, constitute a board of managers of the said corporation, and such other officers as the said corporation shall deem needful; two-thirds of the managers shall be manufacturers or mechanics; the said officers shall be elected at an annual meeting of the said corporation, to

be held on the third Thursday of January; if an election shall not take place on that day, the corporation shall not for that cause be dissolved, but an election shall be held as soon afterwards as may be, and until such election the officers in place shall continue to act; public notice of all elections shall be given in such manner as may be prescribed by the by-laws of the said corporation; the present officers of the said association are hereby constituted the officers of the corporation hereby created and shall continue to hold their respective offices till otherwise elected under the provisions of this act; Provided always, that the said corporation shall have power to increase the number of vice-presidents and managers hereinbefore mentioned, to such number as may be deemed advisable and convenient at a stated meeting of the said corporation, the same public notice of such intended alteration being previously given as may be required to be given of the election of officers of the said corporation.

SEC. 5. And be it further enacted by the authority aforesaid, That the duties and rights of the members of the said corporation, the powers and functions of the members of the said corporation, the powers and functions of the officers thereof hereinbefore mentioned, and of such others as may hereafter be added, the mode of supplying vacancies in office, the times of meeting of the said corporation, and of the board of managers, the numbers which shall constitute a quorum at any such meetings, the mode of electing members, the terms of their admission, the causes which shall justify their suspension or expulsion from the corporation, and all other concerns of the said corporation shall be regulated by the by-laws and ordinances of the said corporation hereafter to be made, which the said corporation is hereby authorized and empowered to make and alter, in the manner which may be therein mentioned; Provided that the said by-laws or ordinances shall not be repugnant to, or inconsistent with, the constitution or laws of the United States or of this Commonwealth.

OFFICE OF THE CLERK OF THE SENATE OF THE COMMONWEALTH OF
PENNSYLVANIA,

March 30th, 1824.

I certify that the foregoing Bill passed both branches of the Legislature, and received the signature of the Governor on this day. As witness my hand the day and year above written.

(Signed.)

JNO. DUPUY, *Clerk.*

An Act to amend and alter the Act incorporating The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts.

WHEREAS, The Act approved March thirtieth, one thousand eight hundred and twenty-four, incorporating The Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, has been found insufficient and inconvenient for accomplishing the objects of said corporation, and the said corporation has applied for alteration and amendment thereof.

SECTION 1. Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania, in General Assembly met, and it is hereby enacted by the authority of the same, that the present members of said corporation, and all such persons as may hereafter become members thereof, shall be, and are hereby created, a body politic and corporate by the name of "THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS," and shall have perpetual succession, be able to sue and be sued, to plead and be impleaded, to have and use a common seal, and the same to break, alter and renew at pleasure, and shall be able to take, hold, purchase and enjoy such real and other estates of any nature or kind whatsoever as they may obtain by purchase, devise, bequest or gift, and the same at their pleasure to sell, lease, mortgage, pledge, encumber, or dispose of as they may deem proper or convenient for promoting the objects of the said corporation; and the said corporation shall have the like power over any real estate or other estates now owned or held by them; *provided*, that the clear yearly value of the real estate at any time held by them shall not exceed ten thousand dollars.

SEC. 2. That it shall be lawful for the said corporation to raise funds for the payment of its present indebtedness, and for all other purposes of the said corporation, to create and sell such number of shares of stock, at ten dollars each, as may be deemed proper to represent the estates of the said corporation, and the certificates of such stock shall be in such form, be transferable in such manner, subject to such payments, and entitle the holder thereof to such privileges, as the said corporation may, by its By-Laws in reference to such stock, grant and direct.

SEC. 3. The object of the said corporation shall be the promotion and encouragement of manufactures and the mechanical and useful arts, by the establishment of lectures on the sciences connected with them, by the formation of cabinets of models, minerals, machines, materials and products by exhibitions and premiums, by a library and by all such measures as they may judge expedient.

SEC. 4. The members of the said corporation shall consist of manufacturers, mechanics, artisans, and persons friendly to the mechanic arts, and of such stockholders in said corporation as may, by the By-Laws, be entitled to the privileges of members; and every member shall pay such sum for an annual or life subscription as the By-Laws of said corporation may require; and honorary and corresponding members may be elected at such times, and in such a way, and with such privileges as said corporation may deem expedient.

SEC. 5. The said corporation shall be managed in such way, and by such number of officers, managers and other persons as the By-Laws may prescribe, and the powers and functions of such officers, managers or other persons, the rights and duties of members, the manner of their election, and the causes which may justify their expulsion or suspension, and all other concerns of the said corporation, shall be fixed and regulated by its By-Laws, which By-Laws shall be adopted by said corporation at the first monthly

meeting after the acceptance of this amended Charter, and said By-Laws shall be altered and amended only in the manner provided in said By-Laws as then adopted.

SEC. 6. So much of the Act to which this is a supplement as is inconsistent herewith is repealed.

OFFICE OF THE SECRETARY OF THE COMMONWEALTH OF PENNSYLVANIA,

April 25th, 1864.

I certify that the foregoing bill passed both branches of the Legislature, and received the signature of the Governor on this day. As witness my hand the day and the year above written.

(Signed.)

ELI SLIFER, *Secretary of the Commonwealth.*

BY-LAWS OF THE INSTITUTE

ARTICLE I.—*Trustees.*

SECTION 1. All Real and Personal Estate of the Institute which may hereafter be acquired by voluntary subscription or devise, bequest, donation, or in any way other than through its own earnings or by investment of its own funds, saving where the donors shall expressly provide to the contrary, shall be taken as acquired upon the condition that the same shall be vested in a Board of Trustees, who shall be appointed in the manner hereinafter indicated. Unless the title to such property shall be directly vested in said Board of Trustees by the donors, the Institute, by deed attested by the President and Secretary, which they are hereby authorized to execute and deliver, shall forthwith convey the same to said Trustees, who shall hold it in trust for the purposes specifically designated by the donors; or, if there shall be no specific designation, for the benefit of the Institute.

SEC. 2. Said Board of Trustees shall be composed of seven (7) members, originally elected by the Board of Managers on its own nomination.

Vacancies, as they occur, shall be filled by election by the Board of Managers from nominations made by the remaining Trustees to a stated meeting of the Board of Managers at least one month prior to the election; the Board of Managers to have the right to reject any nominations not satisfactory to them.

The remaining members of the Board of Trustees, whenever at any time it shall be deemed necessary to do so, shall have power to assign and convey the property held by them, so as to vest the title thereto in themselves and their successors.

SEC. 3. Said Trustees shall have full power and authority, from time to time, to assign, sell and dispose of any property, real and personal, by them held, unless there shall be some direction by the donors to the contrary, and shall have power to convey the same without purchasers being obliged to see to the application of the purchase moneys, when authorized so to do by a

vote of two-thirds ($\frac{2}{3}$) of the members present at any regular or special meeting of the Board of Managers; *provided*, that they shall not be obliged to sell or convey unless a majority of their own Board shall also approve.

SEC. 4. Said Trustees shall not be confined to legal investments, but shall have full power to invest in any real property, improvements and alterations, and in any securities, other than shares of stock, or unusual personal obligations, which to them may seem advisable.

SEC. 5. Said Trustees shall have power to appoint agents to act for them, and for the acts of such agents they shall not be personally responsible where they have exercised ordinary prudence in selecting them.

SEC. 6. Said Trustees shall have power to carry into effect any special trusts upon which any property may be held by them. They shall pay out all necessary and proper costs, charges and expenses, and from time to time shall pay over the net income to the Board of Managers, to be applied by them to the uses of the Institute in accordance with the terms of the trusts from which the income is derived.

SEC. 7. At the annual meeting of the Board of Managers in each year, said Board of Trustees shall present a report of their proceedings and a detailed statement of their receipts and expenditures for the year. An approval of such account shall be final and conclusive, and shall bar any right to demand any other or further accounting.

SEC. 8. The Board of Trustees, at a meeting of the members of the Institute, called after three (3) months' special notice, at which the holders of nine-tenths ($\frac{9}{10}$) of the whole outstanding shares of stock shall vote affirmatively, may convey all property, real and personal, in them vested, to the Institute, free and clear of all trusts; *provided*, that there be no specific trusts violated by such conveyance, and that all the members of said Board, as the same shall then be constituted, shall approve of such conveyance.

ARTICLE II.—*Stock.*

SECTION 1. The Real and Personal Estates of the Institute as held upon the First day of January, One Thousand Eight Hundred and Eighty-one, shall be valued at One Hundred Thousand Dollars, and shall be represented by Ten Thousand Shares of Stock of the par value of Ten Dollars each. Said shares shall be divided into two classes, viz.:—

First Class.—Shares not registered for use: on which no annual payment shall be charged or collected, and the holders thereof shall not have the privileges of members of the Institute, but may, if of legal age, vote at any annual election for officers, managers and auditors, upon the payment of One Dollar upon each share of stock on which they may desire to vote; *provided, however*, such shares have been held by the same person at least three months before such election.

Shares of the First Class may be converted into shares of the Second Class at the pleasure of the owners, provided the transfer be approved by the Board of Managers; but, when once so converted, they shall always continue in the Second Class.

Second Class.—Shares registered for use: on which Twelve Dollars per annum shall be due and payable from resident members in advance on the first day of October in each year, except as hereinafter provided.

Non-resident holders of Second Class stock shall pay an annual fee of Five Dollars.

SEC. 2. The holders of Second Class stock shall be entitled to the use of the library, lectures and reading-room; and, if of legal age, to all other privileges of membership in the Institute, so long as they make the annual payment in advance; and shall, on the payment of One Dollar therefor, be entitled to a Certificate of Membership.

SEC. 3. If the annual dues for successive years remain unpaid at the expiration of two and a half years on any share of stock of the Second Class, such share shall then become forfeited to the Institute; but such forfeiture may be remitted by a unanimous vote of the Board of Managers.

SEC. 4. Stock of the Second Class may be held in trust for persons not of legal age, and shall be liable to the payment of only one-half the annual fees due upon stock of Second Class held by persons of legal age; *provided*, that when such minors arrive at legal age, new certificates, subject to the full annual contribution, shall issue on payment of the customary fee.

SEC. 5. Certificates for the First Class stock may be issued for any number of shares in a single certificate; but every certificate for the Second Class shall be for one share only.

SEC. 6. No share of stock in the Second Class shall be transferred until all arrearages and fines are paid, and all books and tickets returned, and the transfer approved by the Board of Managers.

SEC. 7. All certificates of stock shall be signed by the President and Secretary; shall be issued by the Actuary, and shall be transferable only on the books of the Institute by the owner, or his legal representative, on the surrender of the old certificate, and of a fee of twenty-five cents for each certificate.

SEC. 8. All subscriptions to stock shall be approved by the Board of Managers before the certificate can be issued.

SEC. 9. The shares of stock obtained by the Institute by legacies, donations, or forfeiture shall at once be cancelled.

ARTICLE III.—*Members.*

SECTION 1. The members of the Institute shall consist of manufacturers, mechanics, artisans, and persons friendly to the mechanic arts, and they may be either annual contributors, associate members, life members, permanent members, holders of Second Class stock, honorary or corresponding members.

SEC. 2. The privileges of membership, other than associate membership, in the Institute shall extend only to persons of legal age who are not in arrears and who shall have signed the Charter and By-Laws.

SEC. 3. Annual contributors shall pay yearly dues of Fifteen Dollars; shall be entitled to all of the privileges of the Institute, and shall be eligible to any office or to membership upon any committee.

SEC. 4. Non-resident annual contributors shall pay an entrance fee of Five Dollars and annual dues of Five Dollars.

SEC. 5. Associate members shall be over seventeen and under twenty-five years of age. They shall have the right to attend all meetings of the Institute, use the library, receive the JOURNAL and serve upon committees, but they shall not have the right to vote or to hold office. They shall pay annual dues of Five Dollars. The term of an associate member shall be limited by the age of twenty-five years, after which he shall become an annual contributor with the dues and privileges of that class and he shall be duly notified of the transfer.

SEC. 6. Annual contributors, whether resident, non-resident or associate members, shall be elected by the Board of Managers.

SEC. 7. Honorary and Corresponding Members shall be nominated by the Board of Managers, and shall require for their election four-fifths of the votes of the members present, at any meeting of the Institute at which their nomination may be acted upon. They shall pay no dues.

SEC. 8. Life members, whose membership shall not be transferable, may be elected by the Board of Managers upon the payment of Two Hundred Dollars in any one year.

Non-resident Life members may be elected in the same way upon payment of Seventy-five Dollars in any one year.

SEC. 9. A permanent membership, which may be transferred by will or otherwise, subject to the approval of the Board of Managers, may be granted by the Board of Managers to any one who shall contribute to the Institute for that purpose the sum of One Thousand Dollars in any one year.

SEC. 10. Non-resident members shall be those who reside permanently at a distance not less than twenty-five miles from Philadelphia. Transfers of membership from the resident to non-resident class may be granted by the Board of Managers at its discretion in cases of temporary absence of a member from the city for a period of not less than one year.

SEC. 11. Members shall be entitled to a Certificate of Membership on payment of One Dollar.

SEC. 12. Resignations of membership shall be made to the Board of Managers in writing, but shall not be accepted until all dues, fines, and arrears of dues and current dues at the annual rate up to the date of resignation, shall have been paid, and books and tickets returned.

ARTICLE IV.—*Payments of Dues.*

SECTION 1. The annual payment of fees for membership shall be due and payable on the first of October in each year, in advance; but all members elected after the 31st of March in each year shall pay, in advance, for the current year, one-half of the annual dues.

SEC. 2. Any member whose dues are more than three months in arrears shall be notified by the Actuary. Should such dues not be paid when they become six months in arrears, the privileges of membership shall by that fact be suspended. When nine months in arrears such member shall be

again notified, and if such dues become one year in arrears, the said member shall by that fact forfeit all connection with the Institute. The Board of Managers, however, may, for cause by it deemed sufficient, extend the time for payment and for the application of these penalties.

The Board of Managers may, for sufficient cause, temporarily excuse from payment of annual dues any member who from ill health, advanced age or other good reason assigned, is unable to pay such dues; and the Board may remit the whole or part of the dues in arrears or accept in lieu thereof service or material contributed to the Institute.

SEC. 3. Every person admitted to membership in the Institute shall be considered as liable for the payment of dues until he shall have resigned, been dropped or have been relieved therefrom by the Board of Managers.

SEC. 4. The annual dues from contributing members may be applied to the current expenses of the Institute, but all moneys received from life and permanent membership shall be vested in the Board of Trustees, the income therefrom only to be applied to the maintenance fund.

ARTICLE V.—*Officers.*

The officers shall be a President, three Vice-Presidents, a Secretary, a Treasurer, and twenty-five Managers. A majority of the Managers shall be persons directly interested in industrial pursuits.

ARTICLE VI.—*Election of Officers.*

SECTION 1. An election for officers shall be held on the third Wednesday in January in each year. At this election the President and the Treasurer shall be elected to serve one year, and one Vice-President, and eight Managers, shall be elected to serve for three years; *provided*, that the officers now elected or who may hereafter be elected shall continue to serve until their successors be elected.

One Manager, to be known as the Alumni Manager, shall be elected in January of every third year, beginning in the year 1910, by the Alumni Association of the Institute, to serve for three years. A vacancy in this position shall be filled by election in the same manner for the unexpired term.

The Secretary shall be elected by the Board of Managers at their first stated meeting after the annual election each year.

SEC. 2. All elections for officers of the Institute shall be by letter ballot, and no vote may be cast by proxy, nor received from a member in arrears.

SEC. 3. Nominations for the annual election for officers shall be presented in writing at the stated meeting in the month of December. Each nomination paper must be signed by at least two members in good standing, who shall certify that the candidate will serve if elected. After the nominations are closed, the President shall appoint three members, who are neither officers nor nominees, to act as tellers of the election. The list of nominees shall promptly be posted at the Institute and incorporated (with directions for voting) in a ballot to be sent to each member by the Secretary at least one week before the date of the election. Each ballot shall be accompanied by a

return envelope addressed "To the Tellers of Election," and provided with a space for the signature of the member voting.

SEC. 4. On the date of the annual election, and at an hour previously designated by their chairman, the tellers shall meet at the Institute and shall count all legal votes that have been received by mail or placed in the ballot box before 8 o'clock P. M.; and when the count is completed they shall report to the annual meeting of the Institute the total number of ballots cast, together with the number of votes received by each candidate. Thereupon the presiding officer shall announce the names of the candidates who received the plurality of votes for each office, and shall declare them elected officers of the Institute for the ensuing terms.

ARTICLE VII.—*President.*

It shall be the duty of the President, or, in his absence, of one of the Vice-Presidents, in order of seniority of election, or, in their absence, of a President to be chosen *pro tempore*, to preside at all meetings of the Institute and of the Board of Managers.

ARTICLE VIII.—*Secretary.*

SECTION 1. The Secretary of the Institute shall be a person of scientific attainments. He shall receive such salary as may be fixed by the Board of Managers.

SEC. 2. He shall have general charge and supervision, subject to the Board of Managers, of all the work of the Institute, and of its library, museum, laboratories, and property in general.

SEC. 3. He shall keep the minutes of all meetings of the Institute; and shall perform all the duties usually pertaining to the office of secretary.

SEC. 4. He shall be *ex-officio* a member of the Board of Managers and of all standing committees of the Institute.

SEC. 5. As *ex-officio* Secretary of the Committee on Science and the Arts he shall attend all meetings of that Committee and keep the minutes thereof. He shall also attend meetings of sub-committees at which his attendance has been requested, and when desired shall aid sub-committees in making searches and in the examination of authorities, documents, apparatus, etc.

Two weeks before each stated meeting of the Committee he shall report to its Chairman the status of all investigations pending before the sub-committees.

He shall also perform any other duty that may tend to advance the work of the Committee.

With the approval of the Board of Managers he may appoint an assistant to perform some, or all of his duties as Secretary of this Committee.

ARTICLE IX.—*Treasurer.*

It shall be the duty of the Treasurer to receive from the Board of Trustees all funds, which they may pay over to the Board of Managers in

accordance with Section 6 of Article I. He shall also receive all moneys collected for the Institute by the Actuary. He shall deposit all moneys received, in the name of the corporation, in such institution as the Board of Managers may direct. He shall make no payments without written vouchers from the Board of Managers. He shall keep accurate accounts of the income and disbursements of the Institute, exhibit an accurate statement of his receipts and payments at each stated meeting of the Board of Managers, and of the condition of the finances of the Institute whenever called on by them, and shall make an annual statement thereof at the annual meeting of the Institute. He shall give bonds to an amount fixed by the Board of Managers for the faithful performance of his trust. In case of a vacancy in the office of treasurer, it shall be the duty of the Board of Managers to appoint a person to perform the duties of the position *pro tempore*.

ARTICLE X.—Board of Managers.

SECTION 1. The Board of Managers shall consist of 25 members elected as provided in Article VI; all officers of the Institute, *ex officio*, except the Trustees; and the Chairman of the Committee on Science and the Arts' *ex officio*.

The Board of Managers shall have entire charge and control of the current receipts and expenditures of the Institute, and of all its business affairs not specially reserved to the Board of Trustees, and shall have authority to do all acts not inconsistent with the rights and duties of the Trustees which may in their judgment advance the interests of the Institute.

They shall have authority, by exchange, sale or otherwise, to add to or subtract from the collection of books, furniture and apparatus, in such manner, however, that the aggregate value of the same to the Institute, at any time, may not be impaired.

They shall have authority to elect members of the Institute, except Honorary and Corresponding Members, who shall be elected by the Institute.

SEC. 2. They shall keep regular minutes of their proceedings, which shall be open at all times to inspection by members of the Institute.

SEC. 3. They shall present, at the annual meeting of the Institute, a report of their proceedings and of the condition of the affairs of the Institute.

SEC. 4. They shall hold stated meetings once in each month. They shall elect their own officers, except the chairman, who shall be the President of the Institute, or in his absence, as provided for in Article VII, and shall be at liberty to make by-laws for their own regulation not inconsistent with the Charter, or with the By-Laws of the Institute. Seven of their members shall constitute a quorum.

SEC. 5. All vacancies in the Board of Managers shall be filled by an election at the next stated meeting of the Institute.

ARTICLE XI.—Audits.

The accounts of the Treasurer and Board of Trustees shall be audited

at least once a year by certified public accountants, who shall report to the Board of Managers.

ARTICLE XII.—*Committees of the Institute.*

SECTION 1. There shall be the following Standing Committees, each to consist of ten members, to be appointed by the President, at the first meeting after the annual election, who may be aided in his choice by nominations made at the annual meeting. All members notified of their appointment to any committee, if they do not decline before the next stated meeting, shall be considered members thereof:—

1. On the Library.
2. On the Museum.
3. On Meetings.

SEC. 2. There shall be a Committee on Science and the Arts, consisting of sixty members of the Institute, who shall pledge themselves by their acceptance of membership to perform such duties as may devolve upon them and to sustain by their labors the scientific character of the Institute.

They shall be elected by the Board of Managers at its stated meeting on the fourth Wednesday of January, twenty members being elected each year to serve for three years.

The Secretary shall report to the Board of Managers at said meeting the number of vacancies on the Committee from any cause, and the names of those whose terms expire that year, together with the record of their attendance at meetings of the Committee, and a brief summary of their participation in the work of the Committee and its sub-committees. Vacancies occurring during any year may be filled by the Committee itself by election of members to serve until the following January.

Within one month after the Annual Election, the Committee shall hold a meeting at which it shall elect a Chairman for the current year.

It shall be the duty of the Committee to investigate and report upon any subject referred to it by a vote of the Institute, or any Section thereof, and at its discretion to investigate other subjects on application.

Applications for the examination of any subject shall be made to the Committee, either by recommendation of the Institute, or any Section thereof, or by requests from inventors or others, under the regulations of the Committee.

It shall also be the duty of the Committee to make or recommend the award of medals and other forms of recognition established by, or in charge of, the Institute.

Sub-committees to examine any subject shall be appointed by the Chairman of the General Committee from its membership, but they may include a minority of persons who are not members of the General Committee or of the Institute, but whose expert services are desired in the examination.

Reports of sub-committees shall be made to the General Committee in writing.

Final action on a report conferring or recommending an award shall not be taken by the General Committee except at the second or two successive stated meetings at which it has been read and been open for discussion and amendment.

A quorum for final action upon a report conferring or recommending an award shall consist of not less than fifteen members, and when such report is adopted it shall be accepted as the decision of the Institute.

Reports when issued after final adoption shall set forth that they are the action of The Franklin Institute by its Committee on Science and the Arts. They shall be signed by the President and the Secretary of the Institute and by the Chairman of the Committee; and the seal of the Institute shall be affixed thereto. The Committee may provide that such reports shall also be signed by the members of the respective sub-committees who made the investigations and prepared the reports.

The Chairman of the Committee shall submit to the stated meetings of the Board of Managers in October, December, February, April, and June of each year, a report of the number of investigations pending before the Committee, the number disposed of since the last report, with the action taken or award made in each case, and the number and nature of new investigations undertaken since the last report, and such other information as to the work of the Committee as the Board of Managers may require.

He shall also report to the stated meetings of the Institute such recent action of the Committee as he may deem of interest.

At the request of the Committee on Publications, and to make an adopted report more suitable for use in the JOURNAL of the Institute, the sub-committee that prepared the report shall have authority to amplify or abridge it without in any way changing its meaning or recommendation for award; but the fact of such modification must be stated as a note at the beginning of its publication in the JOURNAL.

SEC. 3. Each committee named in the first and second sections shall choose a chairman at its first meeting after its appointment.

Record of their proceedings shall be kept by the Secretary. They shall report to the Institute, and when required to the Board of Managers.

They shall be governed by such rules, not inconsistent with these By-Laws, as may be adopted by them respectively.

The Committees on the Library, on Meetings, and on Science and the Arts, shall meet at least once in each month, except in July and August.

SEC. 4. No bills for expenses incurred by committees shall be paid unless approved by the Committees which incurred them.

ARTICLE XIII.—*Meetings.*

SECTION 1. The Institute shall hold stated meetings on the third Wednesday of each month, except in June, July, August, and September. That on the third Wednesday in January of each year shall be the annual meeting.

SEC. 2. Special meetings shall be called by order of the President, upon request of the Board of Managers, or the written application of twelve members of the Institute. Fifteen members shall constitute a quorum.

ARTICLE XIV.—*Order of Business.*

SECTION 1. The stated meetings of the Institute shall be held at the hour of 8 o'clock P. M.

SEC. 2. The order shall be as follows :

1. Reading of the Minutes.
2. Reports from the Board of Managers.
3. Reports from the Standing Committees, etc.
 - (1) On the Library.
 - (2) On the Museum.
 - (3) On Meetings.
 - (4) On Science and the Arts.
4. Reports from Special Committees.
5. The paper announced for the evening.
6. The Secretary's report.
7. Deferred business.
8. Consideration of new business.

SEC. 3. At the annual meeting, the tellers' report may be received and read by the Secretary immediately after the conclusion of any number of the order of business.

SEC. 4. The order of business may be altered for any meeting by a vote of two-thirds of the members present thereat.

ARTICLE XV.—*Rules.*

The Institute, at its meetings, shall be governed by Roberts' Rules of Order.

ARTICLE XVI.—*Organization and Government of Sections.*

SECTION 1. For the promotion and encouragement of manufactures and the mechanic arts, as well as of the sciences connected with them, members of the Institute may form sections and hold meetings in such rooms as may be provided for them by the Board of Managers. These sections shall be constituted as hereinafter provided, and shall have precedence in the order of their formation.

SEC. 2. Any number of members, not less than twelve, may constitute a section.

SEC. 3. Members desiring to form a section shall make written application to that effect to the Committee on Sectional Arrangements, which committee shall report such applications to the Board of Managers.

If the application shall be approved by the Board of Managers, the section shall be established and the names of the petitioners shall be recorded on the minutes as the founders of that section, and shall be reported by the Board of Managers to the Institute at its next meeting. Whenever the petitioners shall have organized, they shall report such organization, with the names of their officers, to the Committee on Sectional Arrangements. But if they shall fail to organize such section within six months after the date of said approval, or if an established section shall fail to make a report of its proceedings to the committee during any period of twelve months, it

shall be the duty of the Committee on Sectional Arrangements to inform the Board of Managers, which may thereupon declare that such section is extinct.

SEC. 4. All members of the Institute shall have the privilege of enrolling themselves, without payment of additional fees, as members of any of the sections which are now, or which may hereafter be, established in conformity with these By-Laws, and such enrollments shall be reported from month to month to the secretaries of the sections designated; but no person shall be entitled to any of the privileges of any of the sections who has not complied with the condition of Article III of these By-Laws.

SEC. 5. Each section shall submit to the Committee on Sectional Arrangements prior to the stated meeting of the Board of Managers in December of each year, an estimate of moneys it will require for the ensuing year, and such estimate the Committee on Sectional Arrangements shall transmit, with its recommendation, to the Board at its stated meeting in December.

SEC. 6. Each section shall elect its own officers and make its own by-laws, not inconsistent with the Charter and By-Laws of the Institute. The Institute shall not be responsible for bills contracted by any section in conformity with the conditions prescribed in Section 4 of Article XII of the By-Laws relating to committees, nor in any event for a sum greater in any one year than the amount appropriated by the Board of Managers for the service of the section for that year.

SEC. 7. All requisitions for supplies shall be made by order upon the Actuary of the Institute.

SEC. 8. The books, papers, apparatus, specimens, models, and all other collections of each section, shall be the property of the Institute, held for the use of that section. Donations of objects or books to or for any section, shall be received and reported to the Committee on Sectional Arrangements, and by this committee to the Board of Managers, as donations to the Institute for the use of that section.

SEC. 9. Each section shall determine, subject to the approval of the Board of Managers, the times of its stated meetings.

SEC. 10. Papers read and lectures delivered before any section and approved by the same, shall be referred to the Committee on Publications of the Institute, and if accepted by them, shall be published in the JOURNAL of the Institute.

SEC. 11. Societies now existing, or which may hereafter be founded, for the consideration of any subjects clearly within the scope of The Franklin Institute, and which societies may desire to unite with The Franklin Institute as sections, shall furnish a list of such of their members as have declared their willingness to become members of the Institute, to the Committee on Sectional Arrangements, which committee shall transmit the same, with its recommendation, to the Board of Managers.

SEC. 12. On all points not herein provided for, each section shall be governed by the Charter, By-Laws and usages of the Institute.

ARTICLE XVII.—*Amendments.*

Proposals for amendments to these By-Laws shall be presented in writing, signed by two members in good standing, at any stated meeting of the Institute. By a majority vote of the members present at this meeting they may be considered, amended, referred, postponed, rejected, or ordered to be voted upon at the date of the next stated meeting, until which time they shall be posted at the Institute. The final vote upon amendments shall be by ballot, and if two-thirds of the votes cast are in favor of any proposed amendment, it shall be declared adopted; except that amendments to Article II, relating to capital stock, must (subsequently) be ratified by a majority of the stock represented at a meeting specially called for this purpose.

BY-LAWS OF THE BOARD OF MANAGERS

(As Amended June 8, 1910.)

SECTION 1. *Officers.*—The President of the Institute, or, in his absence, the Vice-President, in order of seniority of election, or in the absence of both, a member elected *pro tempore*, shall preside at all meetings of the Board. Records of its proceedings shall be kept by the Actuary.

SEC. 2. *Meetings.*—The Board shall hold a meeting for the purpose of organizing, electing a Secretary, and a Committee on Science and the Arts; and appointing an Actuary, Standing Committees, etc., on the fourth Wednesday in January, and regular meetings on the second Wednesday of each month, at 3.30 o'clock P. M.

SEC. 3. Special meetings may be called by the President at his discretion, and shall be called on written request of five members of the Board. In case of his absence or refusal to act, such special meeting shall be called by the Actuary.

SEC. 4. *Actuary.*—An Actuary shall be appointed by the Board at their first meeting after the annual election. He shall keep a correct record of their proceedings; keep a roll of the members, and note their attendance thereon; give notice of all meetings of the Board, and of Committees, delivered at least two days prior to the day of meeting; act as Secretary of the following Standing Committees of the Board: on Election and Resignation of Members; on Stocks and Finance; on Exhibitions; on Endowment. He shall notify all committees of the Board of their appointment. He shall collect and receive all moneys due to the Institute, and hand them over to the Treasurer; shall act as agent of the JOURNAL of the Institute, and shall transact such other business of the Institute as the Board shall direct. In all matters he shall be subject to the direction and control of the Board, and he shall receive such yearly compensation as they may determine.

SEC. 5. *Secretary.*—The Secretary of the Institute shall be *ex officio* a member of and act as secretary of the following Standing Committees of the Board: on Instruction; on Publications; on Sectional Arrangements; Executive.

SEC. 6. *Resignations.*—All resignations by members of the Board, after acceptance thereof, shall be reported to the Institute at its next stated meeting.

Members who have not attended six regular meetings prior to the stated meeting of the Institute in December, shall be reported thereat as having resigned, unless it be unanimously voted by the Board, at its stated meeting in December, that such member has been absent for sufficient reason.

SEC. 7. *Standing Committees.*—The following Standing Committees, consisting of five members each, shall be appointed by the President and approved by the Board:

1. On Instruction. 2. On Election and Resignation of Members. 3. On Stocks and Finance. 4. On Publications. 5. On Exhibitions. 6. On Sectional Arrangements. 7. On Endowment. 8. Executive.

It shall be the duty of the Executive Committee to make to the Board such recommendation as it may deem advisable, but in the absence of specific delegation of authority, it shall have no power to act on behalf of the Board.

It shall be the duty of all the committees to keep regular minutes of their proceedings, and report monthly to the Board, and to report through the Committee on Stocks and Finance to the stated meeting of the Board in September, an estimate of moneys they require for the service of the ensuing year.

SEC. 8. *Professorships.*—The Board may, at its discretion, establish such Professorships as may seem advisable, and on such subjects as it may designate, to serve until the next succeeding first meeting after the annual meeting.

SEC. 9. *Order of Business.*—The order at the stated meetings shall be as follows:

1. Calling the roll.
2. Reading the minutes and acting thereon.
3. Report from Treasurer, and action on bills.
4. Report from Standing Committees, and action thereon.
 - (a) On Instruction.
 - (b) On Election and Resignation of Members.
 - (c) On Stocks and Finance.
 - (d) On Publications.
 - (e) On Exhibitions.
 - (f) On Sectional Arrangements.
 - (g) On Endowment.
 - (h) Executive.
5. Reports from Special Committees and action thereon.
6. Deferred Business.
7. New Business.

SEC. 10. *Amendments.*—These By-Laws may be altered at any stated meeting of the Board, provided the alteration be approved by two-thirds of the members present.

event of an accumulation of the fund for medals beyond the sum of one hundred dollars, it is competent for the Committee on Science and the Arts to offer from such surplus a money premium for some special work on any mechanical or scientific subject that is considered of sufficient importance.

The Certificate of Merit.—A Certificate of Merit is awarded to persons adjudged worthy thereof for their inventions, discoveries or productions.

The Boyden Premium (Premium of \$1000).—To any resident of North America who shall determine by experiment whether all rays of light and other physical rays are or are not transmitted with the same velocity.

HISTORY OF THE MEDALS.

The Franklin Medal.—Samuel Insull, Esq., of Chicago, Illinois, writing under date of December 23, 1913, to the Board of Managers, stated that he had been informed it would be a source of gratification to them if the Institute had available, in addition to such medals already in its gifts, a medal to be known as The Franklin Medal, and to be awarded from time to time in recognition of the total contributions of individuals to science or to the applications of physical science to industry, rather than in recognition of any single invention or discovery, however important. He agreed to provide for the founding of this medal under the following general conditions:

1. That an amount not exceeding one thousand dollars should be furnished by him for procuring appropriate designs and dies for the medal and diploma.

2. That the medal should possess distinct artistic merit, and have on one side a medallion of Benjamin Franklin done from the Thomas Sully portrait in the possession of the Institute.

3. That the medal should be of gold and have an intrinsic value of about seventy-five dollars.

4. That the sum of five thousand dollars should be provided by him to be held in trust in perpetuity to be a foundation for this medal, and to be known as The Franklin Medal Fund (Founded January 1, 1914, by Samuel Insull, Esq.).

5. That the interest of this fund should be used from time to time in awarding The Franklin Medal to those workers in physical science or technology, without regard to country, whose efforts have, in the judgment of the Institute, done most to advance a knowledge of physical science or its applications.

6. That any excess of income from this fund, beyond such average annual sum as might be deemed necessary by the Institute for the number of medals it is considered best to award, might be used for premiums to accompany the medals.

Mr. Insull said he understood that the Institute would be glad to award, on the average, two Franklin Medals a year. Though this would leave little surplus, he inserted the sixth condition to prevent an undesirable accumulation of the fund.

AWARDS BY THE INSTITUTE

The following awards are made by The Franklin Institute:

The Franklin Medal.
The Elliott Cresson Medal.
The Howard N. Potts Medal.
The Edward Longstreth Medal.
The Certificate of Merit.
The Boyden Premium.

The making or recommending of these awards is, by resolution of the Institute, entrusted to its Committee on Science and the Arts, a Committee consisting of sixty members of the Institute. This Committee recommends to the Institute the award of the Franklin Medal to distinguished scientists or technologists; and investigates, upon application, and reports on any worthy invention, discovery or process, recommending the award, according to merit, of the Elliott Cresson Medal, the Howard N. Potts Medal, the Edward Longstreth Medal, or the Certificate of Merit.

The Franklin Medal (Gold Medal and Diploma).—This medal is awarded annually from the Franklin Medal Fund, founded January 1, 1914, by Samuel Insull, Esq., to those workers in physical science or technology, without regard to country, whose efforts, in the opinion of the Institute, acting through its Committee on Science and the Arts, have done most to advance a knowledge of physical science or its applications.

The Elliott Cresson Medal (Gold Medal and Diploma).—This medal is awarded for discovery or original research, adding to the sum of human knowledge, irrespective of commercial value; leading and practical utilizations of discovery; and invention, methods of products embodying substantial elements of leadership in their respective classes, or unusual skill or perfection in workmanship.

The Howard N. Potts Medal (Gold Medal and Diploma).—This medal is awarded for distinguished work in science or the arts; important development of previous basic discoveries; inventions or products of superior excellence or utilizing important principles; and for papers of especial merit that have been presented to the Institute and published in its JOURNAL.

The Edward Longstreth Medal (Silver Medal and Diploma).—This medal, with a money premium when the accumulated interest of the fund permits, is awarded for meritorious work in science or the arts. In the

event of an accumulation of the fund for medals beyond the sum of one hundred dollars, it is competent for the Committee on Science and the Arts to offer from such surplus a money premium for some special work on any mechanical or scientific subject that is considered of sufficient importance.

The Certificate of Merit.—A Certificate of Merit is awarded to persons adjudged worthy thereof for their inventions, discoveries or productions.

The Boyden Premium (Premium of \$1000).—To any resident of North America who shall determine by experiment whether all rays of light and other physical rays are or are not transmitted with the same velocity.

HISTORY OF THE MEDALS.

The Franklin Medal.—Samuel Insull, Esq., of Chicago, Illinois, writing under date of December 23, 1913, to the Board of Managers, stated that he had been informed it would be a source of gratification to them if the Institute had available, in addition to such medals already in its gifts, a medal to be known as The Franklin Medal, and to be awarded from time to time in recognition of the total contributions of individuals to science or to the applications of physical science to industry, rather than in recognition of any single invention or discovery, however important. He agreed to provide for the founding of this medal under the following general conditions:

1. That an amount not exceeding one thousand dollars should be furnished by him for procuring appropriate designs and dies for the medal and diploma.

2. That the medal should possess distinct artistic merit, and have on one side a medallion of Benjamin Franklin done from the Thomas Sully portrait in the possession of the Institute.

3. That the medal should be of gold and have an intrinsic value of about seventy-five dollars.

4. That the sum of five thousand dollars should be provided by him to be held in trust in perpetuity to be a foundation for this medal, and to be known as The Franklin Medal Fund (Founded January 1, 1914, by Samuel Insull, Esq.).

5. That the interest of this fund should be used from time to time in awarding The Franklin Medal to those workers in physical science or technology, without regard to country, whose efforts have, in the judgment of the Institute, done most to advance a knowledge of physical science or its applications.

6. That any excess of income from this fund, beyond such average annual sum as might be deemed necessary by the Institute for the number of medals it is considered best to award, might be used for premiums to accompany the medals.

Mr. Insull said he understood that the Institute would be glad to award, on the average, two Franklin Medals a year. Though this would leave little surplus, he inserted the sixth condition to prevent an undesirable accumulation of the fund.

At the Stated Meeting of the Board of Managers, February 11, 1914, the above offer was accepted, and its acceptance was confirmed to Mr. Insull in the following resolutions:

"Resolved, That the Board of Managers of The Franklin Institute of the State of Pennsylvania accept the offer of Mr. Samuel Insull to establish The Franklin Medal, under the conditions named in his letter of December 23, 1913.

"Resolved further, that it is the sense of the Board of Managers of The Franklin Institute that Mr. Insull, in founding this Medal, has rendered a notable service in stimulating workers in Physical Science and Technology and has extended materially the useful activities of the Institute.

"Resolved further, that the thanks of the Board of Managers of the Institute be, and are hereby, extended to Mr. Insull for his generous and greatly appreciated action.

"Resolved further, that an engrossed copy of these resolutions be forwarded to Mr. Insull."

On March 24, 1914, Mr. Insull forwarded his check for six thousand dollars, and the following deed was duly executed and delivered:

KNOW ALL MEN BY THESE PRESENTS, That THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS, hereinafter named The Franklin Institute, for and in consideration of the sum of Six Thousand (\$6,000) Dollars to it in hand paid by Samuel Insull, Esq., the receipt whereof is hereby acknowledged, does hereby certify and declare that it holds and will use said sum of money for the following uses, intents and purposes, and upon the following perpetual trusts, that is to say:

1. To expend One Thousand (\$1,000) Dollars, or so much thereof as may be necessary, for the purpose of paying for the design of a medal, and the necessary dies and diploma plates for the purposes hereinafter set forth.

2. To invest and keep invested the balance of said sum, and from the income derived from such investments from time to time to strike off and award medals from said design to workers in physical science or technology, without regard to country, whose efforts, in the opinion of the Board of Managers of said The Franklin Institute, have done most to advance our knowledge of physical science or its application. Should the income derived from this fund be more than necessary for the purposes aforesaid, the said The Franklin Institute may, in its discretion, award so much of the surplus, as its Board of Managers deems wise, as premiums to accompany said medals.

3. The fund thus set apart shall be known as "The Franklin Medal Fund" (Founded January 1, 1914, by Samuel Insull, Esq.).

4. The medals to be awarded as aforesaid shall be of gold, shall have distinct artistic merit, shall be of the intrinsic value of about seventy-five (\$75) dollars, and shall have on one side thereof a medallion of Benjamin Franklin taken from his portrait by Thomas Sully, now in the possession of the said The Franklin Institute.

IN WITNESS WHEREOF, The said The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts has hereunto set its common or corporate seal, attested by the signatures of its President and Secretary, this 28th day of March, A.D. 1914.

WALTON CLARK,
President.
R. B. OWENS,
Secretary.

[SEAL]

The Elliott Cresson Medal.—Under date of February 18, 1848, Elliott Cresson, Esq., of Philadelphia, Pennsylvania, conveyed to the Trustees for The Franklin Institute one thousand dollars of the six per cent. convertible loan of the President, Managers and Company of the Schuylkill Navigation Company—to hold the said sum and the interest to accrue thereon, for the following uses and purposes:

1. The trustees to keep the principal invested as it now (1848) is until it is reimbursed by the said Company, and immediately after such reimbursement to reinvest the said principal of one thousand dollars in such securities, bearing interest, as may by law be designated for the investment of trust funds. And from time to time, as the said principal sum may be reimbursed, to reinvest the same in like manner.

2. To cause suitable dies to be prepared for striking the gold medal out of the first sufficient moneys received for interest on the said sum of one thousand dollars, the dies to bear the following devices and inscriptions: The obverse,—a medallion likeness of the said Elliott Cresson with inscription around the margin, "Elliott Cresson Medal, A.D. 1848." Reverse,—around the margin, "Awarded by The Franklin Institute of Pennsylvania." The centre to be filled by engraving the name of the party to whom awarded and the year in which the award is made.

3. After the said dies have been prepared, and paid for out of the money received for interest, the said Trustees to cause to be struck, from time to time, such number of gold medals as the interest received will pay for, and to deliver the same to the Treasurer of The Franklin Institute, to be by him transmitted to such persons or parties as the said Franklin Institute may have awarded the same; the said awards, however, to be in all instances made either for some discovery in the arts and

sciences, or for the invention or improvement of some useful machine, or for some new process or combination of materials in manufactures, or for ingenuity, skill or perfection in workmanship.

The Howard N. Potts Medal.—Howard N. Potts, Esq., of Philadelphia, Pennsylvania, died July 24, 1906, leaving a will in which he provided for the establishment of this medal as follows:

"I give and bequeath to The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts and its successors, the sum of one thousand dollars, without deduction for taxes or charges; in trust to invest the same and apply the income thereof or such part or portion of it as may be adequate for the purpose, from time to time, to the purchase of a gold medal, to be awarded in the name of the said Franklin Institute for distinguished work in science or the mechanic arts."

The Edward Longstreth Medal.—In the month of May, 1890, Edward Longstreth, Esq., of Philadelphia, Pennsylvania, retired member of The Baldwin Locomotive Works, deposited with The Franklin Institute in trust, a registered bond of the Baltimore Traction Company for the sum of one thousand dollars, for the founding and perpetuation of the Edward Longstreth Medal of Merit; the interest accruing from said principal sum to be used in procuring and awarding said medals for the encouragement of invention, and in recognition of meritorious work in science and the industrial arts; the said awards to be made by The Franklin Institute through its Committee on Science and the Arts, under such rules as said Committee may adopt.

This donor further presented to The Franklin Institute twelve silver medals and the die therefor designed and executed under the direction of a committee of the Institute with his approval.

On May 14, 1890, the Board of Managers of The Franklin Institute, by resolution, accepted on behalf of the Institute the gifts of the donor, and on September 17, 1890, the Institute, by resolution following, confirmed the acceptance:

"*Resolved*, That the Institute hereby confirms the action of the Board of Managers in accepting the gift of foundation of the Edward Longstreth Medal of Merit, and in expressing its grateful acknowledgments for the gift.

"*Resolved*, That the grant of the Edward Longstreth Medal, in accordance with the wishes of the donor, be entrusted to the Committee on Science and the Arts, subject to such conditions as the said Committee, with the approval of the Institute, may propose."

The obverse of the medal bears the effigy of the donor, and is inscribed around the margin, "The Edward Longstreth Medal of Merit, Founded

1890." On the reverse is inscribed around the margin, "Awarded by The Franklin Institute," and in the centre is engraved the name of the recipient with the date and object of award.

On March 19, 1913, Charles Longstreth, son of the above-named Edward Longstreth, deposited with The Franklin Institute the further sum of one thousand dollars to be added to the original fund to be kept with it in trust in perpetuity, the interest to be used as is the interest of the original fund.

The Certificate of Merit.—At the stated meeting of the Institute, held on June 21, 1882, the following resolution was adopted:

"Resolved, That the Committee on Science and the Arts of The Franklin Institute is hereby authorized to award, and issue to persons by said Committee adjudged worthy, a Certificate of Merit for their inventions, discoveries or productions, which certificate shall read as follows:

'The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, awards to _____ this Certificate of Merit. This award is made pursuant to the recommendation of the Committee on Science and the Arts.

Report No. _____ Approved, _____ 19 _____

President.

[SEAL]

Secretary.

Chairman of the Committee on Science and the Arts.'"

The Boyden Premium.—On March 23, 1859, Uriah A. Boyden, Esq., of Boston, Massachusetts, deposited with The Franklin Institute the sum of one thousand dollars to be awarded as a premium to any resident of North America who shall determine by experiment whether all rays of light, and other physical rays, are or are not transmitted with the same velocity.

The problem has been more specifically defined by the Board of Managers, as follows:

"Whether or not all rays in the spectrum known at the time the offer was made, namely, March 23, 1859, and comprised between the lowest frequency known thermal rays in the infra-red, and the highest frequency known rays in the ultra-violet, which in the opinion of the Committee lie between the approximate frequencies of 2×10^{14} double vibrations per second in the infra-red and 8×10^{14} in the ultra-violet, travel through free space with the same velocity."

An award, made during the year 1907, covered the solution of the problem so far as the transmission of the visible and ultra-violet rays is concerned. It has been directed by the Board of Managers that the balance of the fund be retained, to be awarded to such person as shall demonstrate whether or not the infra-red rays are or are not transmitted with the same velocity as the other rays.

REGULATIONS OF THE COMMITTEE ON SCIENCE AND THE ARTS

ARTICLE I.—*Investigations.*

SECTION 1. The Committee shall investigate, by sub-committee or otherwise, any subject referred to it by the Institute or by any of its sections; and upon a majority vote of the members present at any stated meeting, it may investigate any subject presented on motion of a member or by application as herein provided.

SEC. 2. Secret processes or compounds will not be considered by the Committee; nor will the treatment of materials by any substance be considered, unless the composition used and the method of treatment are fully disclosed.

SEC. 3. Any applicant for investigation of a subject will be furnished by the Secretary with a copy of the regulations governing investigations.

SEC. 4. An application for investigation shall be made in writing on a blank, substantially like "Form A" below, which may be obtained from the Secretary. This application shall be addressed to the Secretary, who will upon receipt refer it to the Sub-Committee on New Subjects and Preliminary Examination; this sub-committee shall recommend to the Committee its acceptance or rejection, upon which the Secretary shall notify the applicant accordingly.

SEC. 5. It shall not be competent for any member of the Committee on Science and the Arts to be an applicant for any of the awards in the gift, or under the recommendation, of the said Committee, unless the subject for award be referred to the Committee by a vote of the Institute.

ARTICLE II.—*Meetings of the Committee.*

SECTION 1. The Committee shall hold stated meetings at 8 o'clock P. M. on the first Wednesday of each month, excepting July and August.

SEC. 2. Special meetings may be called by the Chairman, and shall be called by him upon the written request of five members of the Committee.

SEC. 3. At all meetings of the Committee nine members shall constitute a quorum for transacting general business, but for final action upon a report conferring or recommending an award or for amending the rules of the Committee, a quorum shall consist of not less than fifteen members.

SEC. 4. At its stated meeting the Committee shall proceed in the following

Order of Business:

1. Calling the roll.
2. Reading of the minutes of preceding meeting.
3. Reading of correspondence.

4. Approval of bills.
5. Report of Sub-Committee on New Subjects and Preliminary Examination.
6. Reports of standing and special sub-committees.
7. Consideration of reports for final action.
8. Reports of sub-committees on investigation, first reading.
9. Deferred business.
10. New business.
11. Adjournment.

SEC. 5. Members shall not be entitled to the floor more than twice on any question without the consent of the Committee.

SEC. 6. There shall be no debate on points of order except on an appeal from the decision of the Chairman, or on a question referred by him to the Committee. In such cases no member shall have the floor more than once without the consent of the Committee.

ARTICLE III.—*Chairman.*

SECTION 1. Nominations for a Chairman to serve for one year shall be made at the stated meeting of the Committee in February, and the election shall be by ballot at the same meeting, when the person receiving the highest number of votes shall be declared elected. He shall immediately assume office and shall perform his duties until his successor is installed. He shall not be eligible for election in two successive terms.

SEC. 2. The Chairman shall appoint the members of all sub-committees unless otherwise ordered, and may serve *ex officio* on all sub-committees except those charged with investigations.

SEC. 3. The election of a member as Chairman shall be held to vacate his membership of any and all sub-committees on investigation on which he may be serving, except if he has the report of such Committee prepared or in preparation, in which case he shall complete his work, but when such report is presented for consideration, he shall call on another member to preside while the subject is under discussion.

SEC. 4. The Chairman shall submit to the stated meetings of the Board of Managers in October, December, February, April, and June of each year, a report of the number of investigations pending before the Committee, the number disposed of since the last report, with the action taken or award made in each case, and the number and nature of new investigations undertaken since the last report, and such other information as to the work of the Committee as the Board of Managers may require. He shall also report to the stated meetings of the Institute such recent action of the Committee as he may deem of interest.

ARTICLE IV.—*Standing Sub-Committees.*

SECTION 1. There shall be appointed each February by the Chairman a sub-committee of not less than five members of the Committee, to be styled the "Sub-Committee on New Subjects and Preliminary Examination." The

duties of this sub-committee shall be to keep a general observation of progress made in science and the arts and to report to the Committee subjects adjudged worthy of investigation; to co-operate with the Secretary in keeping the work of the Committee properly before the public, and to recommend at each regular meeting the acceptance or otherwise of all applications for investigation. This sub-committee shall meet at least once prior to each regular meeting of the Committee.

SEC. 2. There shall be appointed each April by the Chairman from the membership with the consent and approval of the Committee, a sub-committee styled the "Sub-Committee on Literature." It shall be the duty of this sub-committee to examine carefully all papers that have been presented to the Institute and published in its JOURNAL during the current year, and to report to the Committee not later than the following April meeting which of these papers deserve the award of, viz.:

1. *The Howard N. Potts Medal;*
2. *The Certificate of Merit.*

The Institute, through the Committee, may award said medals to the authors of papers so recommended, except that it shall not so award more than one Potts Medal in any one year.

The Sub-Committee on Literature shall also consider any publication or treatise devoted to science or the mechanic arts, submitted by the Committee, and if in its judgment said work appears to be of unusual merit it may recommend that its author be awarded the Potts Medal, provided that such medal shall not be so awarded more than once in any one year.

Advertisement of these awards shall not be required.

SEC. 3. There shall be appointed annually by the Chairman from the membership a sub-committee styled the "Sub-Committee on Awarding the Franklin Medal," the duty of which shall be to make recommendations of the award of this medal under the provisions of the deed of gift.

ARTICLE V.—*Sub-Committees on Investigation of Applications.*

SECTION 1. Upon the acceptance of an application for investigation, a sub-committee shall be appointed by the Chairman to conduct the investigation.

SEC. 2. Sub-committees shall be appointed from the membership of the Committee, but they may include a minority of other persons whose expert services are desired in the examination.

SEC. 3. When the personnel of a sub-committee on investigation is finally determined, a notice shall be sent to each member thereof giving the names of the members of the sub-committee and setting forth the regulations governing investigations.

SEC. 4. No person shall be a member of a sub-committee on investigation who is interested in the issue.

SEC. 5. After a subject has been assigned to a sub-committee for investigation it shall not be withdrawn without the consent of the Committee.

SEC. 6. When the Secretary has obtained the necessary information from the applicant, he shall notify the sub-committee, who shall then proceed with the investigation.

SEC. 7. Correspondence between the sub-committee and the applicant must be carried on through the office of the Secretary, in order that the official records shall be complete.

SEC. 8. Sub-committees shall whenever possible make direct examination and tests of the subject under investigation, and shall not accept tests, data or information furnished by others without first satisfying themselves as to the accuracy thereof. They shall in no case recommend an award solely on the basis of tests, data or information furnished by parties in any way interested in the subject of the award. When data submitted by persons not members of the sub-committee are included in the latter's report, it shall be so stated.

SEC. 9. Sub-committees must ascertain that articles, processes, products, etc., examined are genuine samples of the subject under investigation.

SEC. 10. Each sub-committee on investigation shall report its progress to the Committee at intervals of not more than two consecutive stated meetings; and any sub-committee failing so to report for four consecutive stated meetings may be discharged from further consideration of the subject at the discretion of the Chairman, who shall then appoint a new sub-committee to continue the investigation.

SEC. 11. Any member of a sub-committee on investigation failing to discharge his duties may be replaced by another member at the discretion of the Chairman.

SEC. 12. Sub-committees may request applicants to furnish drawings, diagrams or other exhibits for the purpose of investigations and for the records of the Committee.

SEC. 13. When it is found that the subject under investigation has become involved in litigation, the sub-committee shall defer further action until the litigation is terminated, or the Committee decides that the sub-committee may proceed.

ARTICLE VI.—*Sub-Committee Meetings.*

SECTION 1. A quorum for the transaction of business at any meeting of a sub-committee, properly called, shall consist of the one or more members present.

SEC. 2. No applicant or other person interested in the issue of an investigation shall be present at a meeting of a sub-committee or of the Committee except at the invitation of the sub-committee charged with the investigation.

ARTICLE VII.—*Sub-Committees' Reports.*

SECTION 1. Reports of progress and final reports of sub-committees shall be made to the Committee in writing. Final reports shall begin and end substantially as indicated in Form B.

SEC. 2. When a sub-committee on investigation deems the subject upon which it reports worthy of an award of the Elliott Cresson Medal, the Howard N. Potts Medal, the Edward Longstreth Medal, or the Certificate of Merit, it shall include in its report a recommendation to that effect; and such recommendation may be adopted by a majority vote of the Committee, but shall not be changed except by a vote of two-thirds of the members present.

SEC. 3. A report of a sub-committee on investigation, before its acceptance by the Committee, may be edited by the Secretary of the Institute in conjunction with the chairman of the sub-committee, but without materially changing its meaning or effect. The Secretary and chairman may be assisted in this work by the Publications Committee of the Institute, or by an editing committee appointed by the Chairman of the Committee.

SEC. 4. A report of a sub-committee on investigation, before its acceptance by the Committee, shall be signed by a majority of the members of the sub-committee charged with the investigation.

SEC. 5. Any member or members of a sub-committee may file a minority report at least three days prior to the meeting at which the majority report is to be presented.

SEC. 6. No member of a sub-committee shall be permitted to sign a report without having personally examined the subject under investigation, or taken part in its discussion at a meeting of the sub-committee.

SEC. 7. Reports of sub-committees on investigation shall be accompanied by such drawings, diagrams or other exhibits as will serve to elucidate the subject.

SEC. 8. All exhibits pertaining to reports shall be numbered, marked for identification, and signed by the Secretary of the Institute in substantially the following form, and the seal of the Institute shall be impressed thereon:—

Exhibit No. ———, pertaining to report of the Committee on Science and the Arts No. ———

Secretary.

SEC. 9. Reports must be in the Secretary's hands at least one week previous to the stated meeting at which they are to be presented.

SEC. 10. After the report of a sub-committee on investigation has passed its first reading before the Committee, a copy of it may be furnished the applicant, who may make any explanation or objections, in writing, addressed to the Chairman of the Committee; but such writing must be received not later than the next stated meeting of the Committee.

SEC. 11. The report of a sub-committee on investigation may be discussed and amended at the meeting of the Committee at which it is first presented, but shall be laid over for a second reading and fiscal action until the next stated meeting; except where no recommendation of an award is made in the report, when it may, by a majority vote, be finally disposed of after first reading.

SEC. 12. Final action on a report of a sub-committee on investigation recommending an award shall not be taken unless at least one member of the sub-committee who signed the report is present.

ARTICLE VIII.—*Notices of Recommendations.*

SECTION 1. In the case of investigations made upon application, it shall be the duty of the Secretary to certify to applicants the recommendation of the sub-committee within ten days after this recommendation is adopted by the Committee.

ARTICLE IX.—*Reconsideration.*

SECTION 1. Upon the adoption of a report of a sub-committee a motion for reconsideration may not be made before the stated meeting following. If such a motion is then made and accepted, a vote of two-thirds of a quorum for final action shall be required to change the report as previously adopted.

SEC. 2. A second investigation of a subject shall not be ordered except on a vote of two-thirds of the members present at a stated meeting.

ARTICLE X.—*Advertisement of Recommendations.*

SECTION 1. Upon the adoption, by the Committee on Science and the Arts, of a report of a sub-committee on investigation setting forth that a discovery, invention, improvement or manufacture is worthy of an award of the Elliott Cresson Medal, publication shall be made in three successive issues of the JOURNAL of The Franklin Institute, stating that at the expiration of three months from the date of the first publication, the person making such discovery, invention, improvement or manufacture shall be entitled to receive the award of the said medal, unless within that time satisfactory evidence shall have been submitted to the Committee on Science and the Arts of the want of originality or merit, in the supposed discovery, invention, improvement, or manufacture.

SEC. 2. Upon the adoption by the Committee on Science and the Arts of a report of a sub-committee on investigation setting forth that distinguished work in science or the arts is worthy of an award of the Howard N. Potts Medal, publication shall be made in three successive issues of the JOURNAL of The Franklin Institute, stating that at the expiration of three months from the date of the first publication, the person who has done such work shall be entitled to receive the award of the said medal, unless within that time satisfactory evidence shall have been submitted to the Committee on Science and the Arts of the want of originality or merit in the supposed distinguished work in science and the arts.

SEC. 3. The adoption by the Committee on Science and the Arts of a report of a sub-committee recommending an award of the Franklin Medal shall be conclusive without advertisement.

SEC. 4. The adoption by the Committee on Science and the Arts of a report of a sub-committee recommending an award of the Edward Longstreth Medal shall be conclusive without advertisement.

SEC. 5. The adoption by the Committee on Science and the Arts of a report of a sub-committee recommending an award of the Certificate of Merit shall be conclusive without advertisement.

ARTICLE XI.—*Protests.*

SECTION 1. Protests against recommendations advertised by publication in the JOURNAL must be received within three months of the date of first publication. Such protests shall be presented to the Committee at its next stated meeting following date of receipt, and shall be affirmed only by a vote of two-thirds of a quorum for final action, in which case a re-investigation shall be made.

ARTICLE XII.—*Institute Reports.*

SECTION 1. Reports issued by the Institute shall begin and end substantially as in Form C below. They shall be written upon an official form provided by the Institute.

SEC. 2. Reports when issued shall state that they are the action of The Franklin Institute by its Committee on Science and the Arts. They shall be attested by the President and the Secretary of the Institute and by the Chairman of the Committee, and shall be impressed with the seal of the Institute; and they may also bear the names of the members who signed the sub-committee's report.

SEC. 3. It shall be the duty of the Secretary to furnish applicants for investigation with a copy of the Institute's Report.

ARTICLE XIII.—*Amendments to Regulations.*

SECTION 1. Proposals to amend these regulations shall be presented to the Committee in writing, signed by at least two members. They may be considered when presented, but shall not be acted upon until the next stated meeting after presentation, and shall then be adopted if agreed to by two-thirds of the required quorum.

SEC. 2. Notice of proposed amendments shall be sent to each member on the programme for the meeting at which they may be acted upon.

A special committee, appointed for the purpose of preparing a memorandum covering the practice of the committee in the matter of recommending the different awards available to the Institute, presented a detailed report at the Stated Meeting on September 1, 1920, of which the following are the conclusions:

Since much latitude is allowed by the terms of the several medal bequests and no rules for the making of Institute awards conflicting with the purpose and intent of the donors can be made, it is obviously not the part of wisdom to attempt too much in the way of definition but your Committee is of the opinion that future awards might be made with the following general understanding:

1. That the Certificate of Merit be awarded for meritorious inventions, physical processes, and JOURNAL contributions of substantial merit, but not of such merit as would warrant the award of a medal.

2. That the Edward Longstreth Medal be awarded for invention of high order and for particularly meritorious improvements and developments in machines and mechanical processes.

3. That the Howard N. Potts Medal be awarded in recognition of important discoveries in physical science and JOURNAL contributions of the first rank.

4. That the Elliott Cresson Medal be awarded in recognition of inventions of signal value and fundamentally important in the arts and industries.

5. That the Franklin Medal continue to be awarded to those whose efforts have contributed most to a knowledge of physical science and its applications.

REPORT FORMS OF COMMITTEE ON SCIENCE AND THE ARTS

FORM A

(Application for Investigation)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

In the matter of your application to The Franklin Institute for a consideration of your invention or discovery entitled the following data are requested for the information of the Committee on Science and the Arts:

1. What is the specific purpose of the invention?
2. What is the condition of the prior art in this regard?
3. What improvement is claimed to be effected by the invention?
4. How is the improvement effected?
5. What patents, if any, have been issued for this invention?
6. What citations, if any, were made in this regard by the Patent Office before allowance of patent claims?
7. Is the invention now in actual use?
8. If so, since when?
9. Where may it be seen in operation?
10. Are you prepared to submit drawings of the apparatus or device?
11. Are you prepared to submit a model of the apparatus or device?
12. If the invention is a composition of matter, are you prepared to submit specimens of the ingredients and of the compound sufficient for the purpose of experiments?
13. If the invention is a chemical process, are you prepared to give a demonstration of the same?

IMPORTANT TO APPLICANT

This application carefully filled in and other available matters descriptive of the invention or process together with two copies of each of the United States patents issued to applicant must be returned promptly to the Secretary of The Franklin Institute, 15 South Seventh Street, Philadelphia, Pa.

(A copy of Form A, above, may be obtained from the Secretary of the Institute and must be filled in, signed and promptly returned by an applicant for an examination of and a report upon an invention or discovery.)

FORM B
(Sub-committee Report Form)
THE FRANKLIN INSTITUTE
OF THE
STATE OF PENNSYLVANIA
FOR THE
PROMOTION OF THE MECHANIC ARTS

S. & A. Case No.

REPORT OF SUB-COMMITTEE, dated

Investigating

TO THE COMMITTEE ON SCIENCE AND THE ARTS:

Your sub-committee appointed to investigate the above subject report as follows:

.....

| | | |
|-------------------------|---|--|
| In consideration of the | { | discovery excellence of construction ingenuity and novelty or |
|-------------------------|---|--|

of your sub-committee recommends

the award of to of

Respectfully submitted,

..... *Chairman.*

.....

.....

.....

Adopted at the Stated Meeting of 10

FORM C
 (Institute Report Forms)
 THE FRANKLIN INSTITUTE
 OF THE
 STATE OF PENNSYLVANIA
 FOR THE
 PROMOTION OF THE MECHANIC ARTS

HALL OF THE INSTITUTE,

Philadelphia,

S. & A. Case No.

The Franklin Institute of the State of Pennsylvania, acting through its
 Committee on Science and the Arts, investigating
 reports as follows:

In consideration of the {
 discovery
 excellence of construction
 ingenuity and novelty
 or

of the Institute awards the

to of

[SEAL]

..... *President.*

..... *Secretary.*

Countersigned

Chairman of the Committee on Science and the Arts.

delivered before the various sections of the Institute during the year. Your Board records the thought that never before in the history of the Institute has it had a more important and successful lecture year, including in this statement the lectures delivered at the Institute meetings.

The Committee on Meetings, Dr. Alleman, Chairman, reports on the lectures—eight in number—delivered before the Institute at its stated meetings. This report and that of the Committee on Sectional Arrangements are interesting reading. They deal with one of the most important functions of the Institute.

It is appropriate to make mention here of the course of lectures delivered in this room by Dr. F. W. Aston, F.R.S., Fellow of Trinity College, Cambridge, England, on "Atomic Weights and Isotopes." These lectures were delivered on the afternoons of March 6th to 10th inclusive. The attendance, which included physicists from all over the eastern half of the United States, must have been very gratifying to Dr. Aston, as it was to the management of the Institute. Dr. Aston, after finishing the course at the Institute, lectured before eight American universities, before the General Electric Company at Schenectady, and before the Engineers' Club of New York City. It is also worthy of note that Dr. Aston recently has been awarded the Nobel Prize in Chemistry. The Managers think that the Institute is to be congratulated upon the great success of the Aston course and upon the worthy and notable publicity that it has given to the work of The Franklin Institute.

Your Board in its report for the year ending September 30, 1921 told you of the formation of a committee to carry into effect the intent and purpose of the Henry W. Bartol bequest, and advised you of the hopes and ambitions of the Board in connection with the execution of this bequest. The Committee, Mr. Charles Day, Chairman, reports that up to the time of receiving bids for the proposed laboratory building wherein to house the activities of the Bartol Foundation, the work of the Committee was carried on as forecast in our last annual report. At that time, that is, at the time of receiving bids, a serious disappointment was met. A year ago it was estimated that the laboratory building as designed could be erected for \$250,000.00. The lowest bid received was \$650,000.00, and the various bids ranged from that to \$750,000.00. The bids were made at the very peak of cost of building construction and when apparently there was so much construction on hand that there was little desire on the part of constructors to take on added work. At the moment the Committee does not feel justified in recommending the expenditure of such a large proportion of the funds available for the work of the Bartol Foundation and the other laboratory purposes of the Institute, in the erection of a laboratory building. It is giving further consideration to the subject, realizing that it may have to provide for otherwise housing the work of the Foundation. This all makes a regrettable delay. However, the Committee has not to report any lack of confidence that the work will be carried on, and as far as concerns its merit, in full accord with the forecast made in the Managers' report of last year. During this delay in the execution of our plans the Bartol fund is increasing through the accumulation of

income from securities owned, and attention is being given to the creation of an organization suitable for the proper conduct of the work.

The report of the Committee on Instruction, Mr. Paul, Chairman, covers the ninety-eighth year of the School's existence. Two hundred and ninety students were enrolled, 183 less than the unusually large enrollment of the previous year. The Committee records its belief that the cause of the relatively small number of students registering during the year was the industrial depression in Philadelphia. The most marked reduction in the number of students was in the course in Naval Architecture. Other than the fact that we had a reduced enrollment, the School year can be regarded as highly successful from the point of view of the student and of the Institute.

The report of the Committee on Science and the Arts, Dr. Barnes, Chairman, covers its activities during its eighty-eighth year of continuous existence. The Committee's work during the year was little different from that of former years. The Sub-committee on Preliminary Examination considered fifty-six subjects, of which eighteen were recommended for investigation. Fifteen awards were made.

The Committee on Election and Resignation of Members, Mr. Lesley, Chairman, reports the election during the year of 44 members, the resignation of 37, the death of 23, and that 19 were dropped from the rolls for non-payment of dues. The net result is a loss in membership of 35. The Institute has now 1351 members. To comment on this loss in membership and in general on the small membership of the Institute would be only to repeat what has been said in past years, which may be briefly expressed by saying that the failure to attract a larger number of people to membership in an institution so venerable, honorable and useful is inexplicable, though various theories have from time to time been advanced in explanation.

Notable among the members of the Institute whose deaths we have sadly to record were Alfred W. Gibbs, a member of the Board of Managers from 1915 to 1922, and Coleman Sellers, Jr., for sixteen years Manager or Vice-President of the Institute.

Mr. Gibbs brought to the work of the Institute the fruit of many years' engineering experience and the will to devote that experience to the advancement of the mechanic arts through the medium of The Franklin Institute. His contributions to science were notable; his personality as well as his unfailing good sense made him an agreeable associate and a wise counsellor. He is greatly missed.

Coleman Sellers, Jr., by tradition and through inheritance was deeply interested in the work of the Institute. Turning to the YEAR BOOK we find that Mr. Sellers and his forebears have occupied the positions of Manager, Vice-President and President of The Franklin Institute for a total of approximately eighty years,—four-fifths of the Institute's life. Through three generations the Sellers' family have been prominent in the work of the Institute. Those of us who knew Coleman Sellers, Jr., and were witnesses of the ability and good-will brought by him to the service of science can judge what a profound and beneficial influence must have been

the eighty years of the Sellers' participation in the Institute's work. Those of us who knew Coleman Sellers, Jr., in his relation to his fellow man realize that in his death the Institute has lost a wise and devoted counsellor, the Commonwealth a citizen of the finest type, and his personal friends a rare and lovable associate.

The principal item of interest in the report of the Committee on Endowment, Mr. Clamer, Chairman, is the statement that the Institute has received during the year from the Pennsylvania Company for Insurance on Lives and Granting Annuities, \$1,997.22—being the Institute's share in the further distribution of the estate of Harriet Blanchard, deceased, and making a total of \$57,549.00 received from the estate. The Committee also reports on the transfer of certain securities in connection with the settlement with the widow and daughters of Mr. Henry W. Bartol.

The Committee on Stocks and Finance, Mr. Forstall, Chairman, reports that the Institute's financial condition continues sound, although as generally during the Institute's life, our operating expenses have exceeded our operating revenue. The Board has anticipated this condition, and as they have told you from year to year they are not disturbed by it. The work of the Institute continues to cost more than the income of the Institute, less donations and bequests, affords. This cost, however, over a period of years, is much less than our regular income plus the occasional bequests and gifts applicable to operating expenses. We are continuing to carry on the work, spending what is necessary to the efficient conduct of the Institute's activities, in full confidence that in the future, as for the past ten or fifteen years, our total income applicable to operating expenses will continue to be larger than our total operating expenses. We have assured you before, and we assure you now, that while we are committing ourselves to the expenditures necessary for the proper conduct of our work, it is never to the extent of imperilling any creditor's interest or of using any trust funds other than as designated by their donors. We hope that this policy meets your approval, as it has met it in the past.

The difference between our so-called "regular income"—that is, income from all sources other than gifts and bequests—and our expenditures, is \$10,016.93, which is the so-called "deficit" from the year's operations. Aside from the Bartol bequest, the total of funds held by the Institute has increased approximately \$19,000.00, of which approximately \$16,000.00 was from interest earned on the Franklin Institute Building Fund.

The Committee on Library, Mr. Hall, Chairman, reports the addition to the library during the year of 1452 volumes and 1491 pamphlets. There were many gifts of books, pamphlets and magazines, notable among them a gift from Mr. F. H. Shelton of an unique and valuable collection of books and pamphlets on windmills. Included in Mr. Shelton's gift were several treatises on the subject printed in German and Dutch in the seventeenth and eighteenth centuries. Mr. Shelton also donated to the Institute two volumes in manuscript prepared by himself and a book containing 400 views of windmills in all parts of the world.

The funds at the disposal of the Library Committee—approximately

\$5,500.00 per year, are inadequate for the useful work that the Library Committee might accomplish in the purchase of books and the binding of volumes and pamphlets. For the present we must content ourselves with an annual expenditure approximating the above amount. As in previous years, we have to record that while our library attendance is small, due in part to the location of our building, it is to be noted, that a large proportion of the people who come to the library come to consult many books and often spend days in such consultation.

Such, in brief, is the history of the Institute's activities during the year ending September 30, last. In some respects the record is unique. Notable among its features is the precedent established by the visit of Dr. Aston, above referred to. Your Board confidently anticipates that the precedent so brilliantly established will be maintained and that in the future from year to year we will be able to present to the scientists of America, courses of lectures upon scientific matters of interest by the leading scientists of the world. We anticipate that Prof. J. J. Thomson will visit the Institute the coming spring for the delivery of a series of lectures upon "The Electron in Chemistry." We are enabled to arrange this through the generosity of friends in the electrical industry who give this additional evidence of their intelligent interest in scientific matters and in The Franklin Institute. The success of the Institute in carrying out its plans in this respect, bringing to the Institute some of the most inspiring personalities of the world of science, must result in a notable stimulation of the scientific life of America.

Members of The Franklin Institute: Our institution is about to enter on the last year of its first century of life. Through one hundred years, unaided by National, State or municipal support, the Institute has given efficient service in the promotion of physical science—in time of peace knowing no national boundaries, its only recognized frontier being the advanced line of scientific endeavor—in time of war bending every energy to the aid of the nation in arms. This is the example set for us by four generations of men. It becomes us in these latter months of the Institute's first century of existence to resolve to so continue its work during the fraction of its life under our influence that men in the expiring hours of other centuries, seeing our accomplishment in perspective, shall judge us to have been not unworthy custodians of the life and traditions of The Franklin Institute. In our time there must be no break in the line of honorable tradition.

Membership in our institution has its responsibilities as well as its privileges. A part of your responsibility as members is to make sure that the men you entrust with official position are men of such capacity and good intent as insures the maintaining of our century old standards. Not otherwise than by recognizing and meeting this responsibility can you justify your membership in this venerable and honorable institution. The Franklin Institute is worthy of the best. It is for you to see that it has the best. As of today its destinies are in your hands.

Respectfully submitted,

WALTON CLARK,
President.

PHILADELPHIA, January 17, 1923.

REPORT OF THE COMMITTEE ON LIBRARY

For the Fiscal Year Ending September 30, 1922.

To the President and Members of The Franklin Institute:

The Committee on Library respectfully submits the following statement of activities in the library during the year ending September 30, 1922.

The additions to the library were as follows:

| Source | Bound Volumes | Unbound Volumes | Pamphlets |
|-------------------------------|------------------|--------------------|-----------|
| By Gift | 420 | 284 | 1488 |
| Binding | 467 | | |
| Purchase | | | |
| Books and Periodicals Account | 8 | 2 | |
| Jayne Fund | 5 | 1 | |
| Journal | 34 | 13 | 2 |
| Lea Fund | 35 | 3 | |
| Levy Fund | 7 | 3 | 1 |
| Memorial Library Fund | 8 | | |
| Miscellaneous Expense Acct. . | 1 | 1 | |
| Moore Fund | 62 | 34 | |
| Morris Fund | 17 | | |
| Periodicals Completion Fund . | 15 | | |
| Potts Fund | 5 | 2 | |
| Ware Fund | 18 | 7 | |
| | <hr/> | <hr/> | <hr/> |
| | 1102 | 350 | 1491 |

Total additions for the year2943

An increase of forty-two titles over the preceding year.

The Committee had at its disposal \$3,250 appropriated by the Board of Managers and \$2,278.42, the income from the various trust funds.

The expenditures for the year were \$1,251.05 for binding, \$3,468.41 for books and subscriptions to magazines and other periodical publications and \$211.20 for general expenses.

Gifts of books, pamphlets, and magazines in large quantities or of special interest were received from Messrs. H. A. Freeman, F. A. Shelton, John C. Trautwine, Jr., Henry W. Wilson, The U. S. Metallic Packing Company, Mrs. George R. Henderson, Professor Lewis M. Haupt and the Engineers' Club of Philadelphia. Mr. Shelton's gift consisted of a unique collection of books and pamphlets on windmills including treatises on the subject in German and Dutch printed in the seventeenth and eighteenth centuries, also two volumes in manuscript prepared by Mr. Shelton and a book containing 400 views of windmills in all parts of the world. Mr. Shelton also presented a number of volumes on gas and gas manufacture.

The contents of the library on September 30, 1922 were:

| | |
|----------------------------------|--------|
| Volumes, bound and unbound | 77,364 |
| Pamphlets | 18,611 |
| Maps and Charts | 2,292 |
| Photographs | 1,349 |

Binding:

During the year the following work was done by the binders:

| | |
|---|-----------|
| Recent volumes of periodicals bound | 319 |
| 1134 pamphlets bound | 79 |
| Recent volumes of foreign chemical periodicals bound and charged to the Chemical Periodical Binding Fund | 33 |
| Volumes charged to the Morris Fund | 36 |
| Old volumes, bound and rebound | 57 |
| | <hr/> 524 |

Magazines and Other Periodical Publications:

6550 copies of the JOURNAL were used for exchange purposes.

Twenty-seven exchanges were added to the mailing list and one hundred and fifty-four were discontinued.

The total number of exchanges on September 30th was 459. The subscriptions totaled 172 and the number of gift subscriptions was 74, making the total number of periodical publications received, 705.

Evening Hours:

The library was open on twenty-eight meeting nights until ten o'clock, with a total attendance after six o'clock of 47 members.

Respectfully submitted,

CLARENCE A. HALL,
Chairman.

PHILADELPHIA, January 10, 1923.

REPORT OF THE COMMITTEE ON MUSEUM

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1922.

To the President and Members of The Franklin Institute:

The following models, apparatus and specimens have been added to the Institute's collection since the date of the last report:

Working model done to scale of the original Van Depocle tram-car, one of the earliest electrical lines to run in New England in the vicinity of Ansonia and Derby. It was capable of carrying twenty-five tons of freight. Presented by Mr. L. S. Storrs, President, The Connecticut Company, New Haven, Connecticut. A full description of this model appears in the Proceedings of the Stated Meeting of the Institute held November 16, 1921, (J. F. I., Vol. 192, page 819).

The first blanket of camels wool taken from the first loom erected in the

mill at Tien-Tsin, China, in February, 1900. Presented by Mr. R. A. Difenderfer of Elkins Park, Pennsylvania.

A specimen each of American white pine and American white oak being portions of the original timber used in the construction of the Trenton Bridge of the Delaware River, placed there in 1803 and removed in 1875 after seventy-two years of constant service. Presented by Mr. Henry W. Wilson, member of the Institute.

Seventeen samples of copals and gums used in the manufacture of varnish. Presented by Mr. Joseph R. Stulb, C. Schrack and Company, Philadelphia.

A 6-A economy gas cabinet stove made about 1885 by the American Meter Company of New York and Philadelphia. Presented by the Borden Stove Company of Philadelphia.

Five wooden clock movements, early 19th century. Presented by Mr. B. F. Schmauk, Philadelphia.

Twenty-two sheets of manuscript with original drawings of road-making and agricultural machinery, sailing vessels and apparatus for coast defense formerly the property of Dr. Thomas Ruston, a friend of General Washington. Presented by John F. Lewis, Esquire, Philadelphia.

Photograph of painting of Henry Morton by A. D. Turner. Original in the possession of the Stevens Institute of Technology. Presented by Dr. Alex. C. Humphreys. (Dr. Morton was the first Resident Secretary of The Franklin Institute, having served from 1865 to 1870.) *

Mrs. George R. Henderson presented to the Institute the following apparatus formerly belonging to her husband, a member of the Institute's Board of Managers from 1915 to 1921:

- One four inch telescope,
- One spectroscope made by John Brashear,
- One case of direct reading hydrometers and thermometers,
- Two boxes of graduated scales,
- One Beck microscope with attachments,
- One set of drawing instruments,
- One micrometer (Brown and Sharpe),
- One draftsman's steel protractor,
- One hand level (Keuffel and Esser Company),
- One astronomical globe made by Mr. Henderson.

Respectfully submitted,

ALEX. E. OUTERBRIDGE, JR.,
Chairman.

PHILADELPHIA, January 10, 1923

REPORT OF THE COMMITTEE ON MEETINGS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1922.

To the President and Members of The Franklin Institute:

Eight stated meetings were held during the year ending September 30, 1922. These were held on the third Wednesday of each month, from October

to May inclusive, at the hour of eight o'clock, with the exception of that of May 17 which was held at three-thirty o'clock in the afternoon. The following is a list of dates and speakers with titles and synopses of their communications:

October 19, 1921: Ralph Modjeski, D. Eng., Chief Engineer, Delaware River Bridge Joint Commission, Philadelphia, Pennsylvania, member of the Institute presented a paper on "The Delaware River Bridge between Philadelphia and Camden." The speaker gave an account of the comparative study and considerations which led to the adoption of the suspension type of bridge and described the salient features and characteristics of the design. The subject was illustrated by lantern slides from the engineers' drawings and views of the bridge as it will appear when completed. The paper was printed in full in the January, 1922 issue of the JOURNAL.

At this meeting the Elliott Cresson Medal was presented to Dr. Byron E. Eldred of New York City for his invention of "Low Expansion Leading-in Wire for Incandescent Electric Lamps."

The Howard N. Potts Medal was presented to Mr. Alfred O. Tate, of Cranston, Rhode Island, for his process of water-proofing fabrics.

November 16, 1921: Heber D. Curtis, Ph.D., Director of the Allegheny Observatory, Pittsburgh, Pennsylvania, presented a paper on "The Spiral Nebulae and their Interpretation." The speaker pointed out that of all known classes of celestial objects, the spirals are perhaps the most difficult to fit into any coherent scheme of stellar evolution, either as a point of origin or as an evolutionary product. In form, in distribution, and in space velocity, they stand apart from all other objects observed in the Milky Way. Much modern observational evidence supports the belief that these beautiful objects are separate galaxies of stars, or "island universes," comparable with our own galaxy in size and in number of component suns. Evidence for and against the island universe theory of the spirals was presented. The subject was illustrated by lantern slides.

At this meeting Mr. L. S. Storrs presented to the Institute a beautifully constructed working model, done to scale, of the original Van Depoele motor.

The Edward Longstreth Medal was presented to His Excellency, James Hartness, Governor of Vermont, the inventor of the Hartness Screw Thread Comparator.

The Edward Longstreth Medal was also presented to Mr. Thomas Willing Hicks for his "Once-over" Tiller.

December 21, 1921: P. H. Bates, A.B., B.S., Chief, Structural and Miscellaneous Materials Division, Bureau of Standards, Washington, District of Columbia, presented a paper on "The Application of the Fundamental Knowledge of Portland Cement to Its Manufacture and Use."

The results of various attempts to determine the mineral constituents of Portland cement, culminating in the successful attempt of Rankin, were reviewed. The work of the Bureau of Standards in determining the physical properties of the different constituents was described. The relative amounts of these occurring in cement of normal manufacture, and the possibility and

economy of producing, in the process of manufacture, the determined amount of any constituent were discussed. The quality of cements of relatively the same composition but different constitution, the desirability of more refined methods of testing to determine the qualities not revealed by present tests and the need of cements of different qualities for different uses were also considered. The subject was illustrated by lantern slides. The paper was printed in full in the March, 1922 issue of the JOURNAL.

January 18, 1922: Honorable William D. B. Ainey, LL.D., L.H.D., Chairman of The Public Service Commission of Pennsylvania, presented a paper on "The Highway System of the State of Pennsylvania." Consideration was given to the subject of transportation as a factor in national development and the importance of highways as transportation means. An outline was given of the historical development of highway construction programs as well as the beginnings and accomplishments of the State Highway System. Brief reference was also made to the past, present and future bearing upon the economic conditions of the State. At the close of his remarks, the speaker called upon Mr. Harold E. Hiltz, Assistant Engineer of the Construction Division, State Highway Department, who exhibited a series of lantern photographs of machinery and apparatus used in the construction of roads, as well as a number of views of completed roads in various parts of the state. He described materials used in road building and the methods of their application.

February 15, 1922: L. J. Briggs, M.S., Ph.D., Chief, Engineering Physics Division, Bureau of Standards, Washington, District of Columbia, presented a paper on "The Resistance of the Air." Wind-tunnels for obtaining air-streams of known velocity were described as well as aerodynamical balances for measuring air forces on a model; reference was made to the air-resistance equation and dynamical similarity in air-resistance measurements. Consideration was given to the air-resistance of bodies of various forms and to air-foils. Reference was also made to the problem of the measurement of the resistance of projectiles. The subject was illustrated by lantern slides.

March 15, 1922: M. deKay Thompson, Ph.D., Associate Professor of Electrochemistry, Massachusetts Institute of Technology, Cambridge, Massachusetts presented a paper on "Recent Progress in Applied Electrochemistry." An account was given of the recent progress in the different branches of electroplating, batteries, and the manufacture of numerous substances by electrolysis and electrothermic means. The subject was illustrated by lantern slides. This paper was printed in full in the June, 1922 issue of the JOURNAL.

April 19, 1922: William D. Harkins, Ph.D., Department of Chemistry, University of Chicago, Chicago, Illinois, presented a paper on "The Structure and Building of Atom Nuclei." The speaker stated that the atom seems to consist of a central positive nucleus which plays the part of the sun in the solar system surrounded by a system of negative planetary electrons. The number of these planetary electrons is equal to the charge on the nucleus.

If an atom loses one or more of its planetary electrons, it easily picks up other negative electrons and becomes restored to its initial condition.

PRESIDENT'S REPORT AND REPORTS OF THE COMMITTEES OF THE INSTITUTE AND THE COMMITTEES OF ITS BOARD OF MANAGERS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1922.

REPORT OF THE PRESIDENT

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1922.

To the Members of The Franklin Institute:

Your Board of Managers has instructed me to report to you on the affairs of the Institute for the Institute year ending September 30, 1922, as follows:

The Managers hope that reading this report and the reports of the several committees of the Board and of the Institute, as they will appear in the 1923 YEAR BOOK, will lead you to the conclusion that the work of the Institute was carried on through the year—as they believe—with results favorably comparable with those of previous years.

Following our established order, the Managers make such brief comment on these reports as seems suitable.

The Committee on Museum, Mr. Outerbridge, Chairman, reports the addition to the Museum of certain models and apparatus of interest, notable among them a working model of the original Van Depoele electric tram car, donated by Mr. L. S. Storrs, and a valuable set of scientific instruments once owned by the late George R. Henderson and donated by his widow. Our facilities for exhibiting our models, of which we have many of great scientific and historic interest, have not improved, and will not improve until we are able to store and properly display them in another building erected in whole or in part for the purpose. The provision of such a building is a part of our plans for the future, as more particularly discussed in our report for the Institute year ending September 30, 1921.

The Committee on Publication, Dr. Rosengarten, Chairman, reports the completion of the one-hundred and ninety-fourth volume of the JOURNAL. The Committee refers briefly to the contents of the JOURNAL for the current year and to the YEAR BOOK. The Committee reports that the demand for the work on the "Physics of the Air" by Dr. W. J. Humphreys, continues. Twelve hundred and fifty-four volumes have been sold since the work was issued less than two years ago. The evidence continues that the book is of great value to meteorologists and aviators and that The Franklin Institute has been more than justified in undertaking its publication.

The Committee on Exhibitions, Mr. Benjamin Franklin, Chairman, reports again on the contemporary status of the Sesqui-Centennial Exhibition in so far as it affects The Franklin Institute.

The report of the Committee on Sectional Arrangements, Dr. Keller, Chairman, records with some detail the lectures—nineteen in number—

delivered before the various sections of the Institute during the year. Your Board records the thought that never before in the history of the Institute has it had a more important and successful lecture year, including in this statement the lectures delivered at the Institute meetings.

The Committee on Meetings, Dr. Alleman, Chairman, reports on the lectures—eight in number—delivered before the Institute at its stated meetings. This report and that of the Committee on Sectional Arrangements are interesting reading. They deal with one of the most important functions of the Institute.

It is appropriate to make mention here of the course of lectures delivered in this room by Dr. F. W. Aston, F.R.S., Fellow of Trinity College, Cambridge, England, on "Atomic Weights and Isotopes." These lectures were delivered on the afternoons of March 6th to 10th inclusive. The attendance, which included physicists from all over the eastern half of the United States, must have been very gratifying to Dr. Aston, as it was to the management of the Institute. Dr. Aston, after finishing the course at the Institute, lectured before eight American universities, before the General Electric Company at Schenectady, and before the Engineers' Club of New York City. It is also worthy of note that Dr. Aston recently has been awarded the Nobel Prize in Chemistry. The Managers think that the Institute is to be congratulated upon the great success of the Aston course and upon the worthy and notable publicity that it has given to the work of The Franklin Institute.

Your Board in its report for the year ending September 30, 1921 told you of the formation of a committee to carry into effect the intent and purpose of the Henry W. Bartol bequest, and advised you of the hopes and ambitions of the Board in connection with the execution of this bequest. The Committee, Mr. Charles Day, Chairman, reports that up to the time of receiving bids for the proposed laboratory building wherein to house the activities of the Bartol Foundation, the work of the Committee was carried on as forecast in our last annual report. At that time, that is, at the time of receiving bids, a serious disappointment was met. A year ago it was estimated that the laboratory building as designed could be erected for \$250,000.00. The lowest bid received was \$650,000.00, and the various bids ranged from that to \$750,000.00. The bids were made at the very peak of cost of building construction and when apparently there was so much construction on hand that there was little desire on the part of constructors to take on added work. At the moment the Committee does not feel justified in recommending the expenditure of such a large proportion of the funds available for the work of the Bartol Foundation and the other laboratory purposes of the Institute, in the erection of a laboratory building. It is giving further consideration to the subject, realizing that it may have to provide for otherwise housing the work of the Foundation. This all makes a regrettable delay. However, the Committee has not to report any lack of confidence that the work will be carried on, and as far as concerns its merit, in full accord with the forecast made in the Managers' report of last year. During this delay in the execution of our plans the Bartol fund is increasing through the accumulation of

income from securities owned, and attention is being given to the creation of an organization suitable for the proper conduct of the work.

The report of the Committee on Instruction, Mr. Paul, Chairman, covers the ninety-eighth year of the School's existence. Two hundred and ninety students were enrolled, 183 less than the unusually large enrollment of the previous year. The Committee records its belief that the cause of the relatively small number of students registering during the year was the industrial depression in Philadelphia. The most marked reduction in the number of students was in the course in Naval Architecture. Other than the fact that we had a reduced enrollment, the School year can be regarded as highly successful from the point of view of the student and of the Institute.

The report of the Committee on Science and the Arts, Dr. Barnes, Chairman, covers its activities during its eighty-eighth year of continuous existence. The Committee's work during the year was little different from that of former years. The Sub-committee on Preliminary Examination considered fifty-six subjects, of which eighteen were recommended for investigation. Fifteen awards were made.

The Committee on Election and Resignation of Members, Mr. Lesley, Chairman, reports the election during the year of 44 members, the resignation of 37, the death of 23, and that 19 were dropped from the rolls for non-payment of dues. The net result is a loss in membership of 35. The Institute has now 1351 members. To comment on this loss in membership and in general on the small membership of the Institute would be only to repeat what has been said in past years, which may be briefly expressed by saying that the failure to attract a larger number of people to membership in an institution so venerable, honorable and useful is inexplicable, though various theories have from time to time been advanced in explanation.

Notable among the members of the Institute whose deaths we have sadly to record were Alfred W. Gibbs, a member of the Board of Managers from 1915 to 1922, and Coleman Sellers, Jr., for sixteen years Manager or Vice-President of the Institute.

Mr. Gibbs brought to the work of the Institute the fruit of many years' engineering experience and the will to devote that experience to the advancement of the mechanic arts through the medium of The Franklin Institute. His contributions to science were notable; his personality as well as his unfailing good sense made him an agreeable associate and a wise counsellor. He is greatly missed.

Coleman Sellers, Jr., by tradition and through inheritance was deeply interested in the work of the Institute. Turning to the YEAR BOOK we find that Mr. Sellers and his forebears have occupied the positions of Manager, Vice-President and President of The Franklin Institute for a total of approximately eighty years,—four-fifths of the Institute's life. Through three generations the Sellers' family have been prominent in the work of the Institute. Those of us who knew Coleman Sellers, Jr., and were witnesses of the ability and good-will brought by him to the service of science can judge what a profound and beneficial influence must have been

the eighty years of the Sellers' participation in the Institute's work. Those of us who knew Coleman Sellers, Jr., in his relation to his fellow man realize that in his death the Institute has lost a wise and devoted counsellor, the Commonwealth a citizen of the finest type, and his personal friends a rare and lovable associate.

The principal item of interest in the report of the Committee on Endowment, Mr. Clamer, Chairman, is the statement that the Institute has received during the year from the Pennsylvania Company for Insurance on Lives and Granting Annuities, \$1,997.22—being the Institute's share in the further distribution of the estate of Harriet Blanchard, deceased, and making a total of \$57,549.00 received from the estate. The Committee also reports on the transfer of certain securities in connection with the settlement with the widow and daughters of Mr. Henry W. Bartol.

The Committee on Stocks and Finance, Mr. Forstall, Chairman, reports that the Institute's financial condition continues sound, although as generally during the Institute's life, our operating expenses have exceeded our operating revenue. The Board has anticipated this condition, and as they have told you from year to year they are not disturbed by it. The work of the Institute continues to cost more than the income of the Institute, less donations and bequests, affords. This cost, however, over a period of years, is much less than our regular income plus the occasional bequests and gifts applicable to operating expenses. We are continuing to carry on the work, spending what is necessary to the efficient conduct of the Institute's activities, in full confidence that in the future, as for the past ten or fifteen years, our total income applicable to operating expenses will continue to be larger than our total operating expenses. We have assured you before, and we assure you now, that while we are committing ourselves to the expenditures necessary for the proper conduct of our work, it is never to the extent of imperilling any creditor's interest or of using any trust funds other than as designated by their donors. We hope that this policy meets your approval, as it has met it in the past.

The difference between our so-called "regular income"—that is, income from all sources other than gifts and bequests—and our expenditures, is \$10,016.93, which is the so-called "deficit" from the year's operations. Aside from the Bartol bequest, the total of funds held by the Institute has increased approximately \$19,000.00, of which approximately \$16,000.00 was from interest earned on the Franklin Institute Building Fund.

The Committee on Library, Mr. Hall, Chairman, reports the addition to the library during the year of 1452 volumes and 1491 pamphlets. There were many gifts of books, pamphlets and magazines, notable among them a gift from Mr. F. H. Shelton of an unique and valuable collection of books and pamphlets on windmills. Included in Mr. Shelton's gift were several treatises on the subject printed in German and Dutch in the seventeenth and eighteenth centuries. Mr. Shelton also donated to the Institute two volumes in manuscript prepared by himself and a book containing 400 views of windmills in all parts of the world.

The funds at the disposal of the Library Committee—approximately

income from securities owned, and attention is being given to the creation of an organization suitable for the proper conduct of the work.

The report of the Committee on Instruction, Mr. Paul, Chairman, covers the ninety-eighth year of the School's existence. Two hundred and ninety students were enrolled, 183 less than the unusually large enrollment of the previous year. The Committee records its belief that the cause of the relatively small number of students registering during the year was the industrial depression in Philadelphia. The most marked reduction in the number of students was in the course in Naval Architecture. Other than the fact that we had a reduced enrollment, the School year can be regarded as highly successful from the point of view of the student and of the Institute.

The report of the Committee on Science and the Arts, Dr. Barnes, Chairman, covers its activities during its eighty-eighth year of continuous existence. The Committee's work during the year was little different from that of former years. The Sub-committee on Preliminary Examination considered fifty-six subjects, of which eighteen were recommended for investigation. Fifteen awards were made.

The Committee on Election and Resignation of Members, Mr. Lesley, Chairman, reports the election during the year of 44 members, the resignation of 37, the death of 23, and that 19 were dropped from the rolls for non-payment of dues. The net result is a loss in membership of 35. The Institute has now 1351 members. To comment on this loss in membership and in general on the small membership of the Institute would be only to repeat what has been said in past years, which may be briefly expressed by saying that the failure to attract a larger number of people to membership in an institution so venerable, honorable and useful is inexplicable, though various theories have from time to time been advanced in explanation.

Notable among the members of the Institute whose deaths we have sadly to record were Alfred W. Gibbs, a member of the Board of Managers from 1915 to 1922, and Coleman Sellers, Jr., for sixteen years Manager or Vice-President of the Institute.

Mr. Gibbs brought to the work of the Institute the fruit of many years' engineering experience and the will to devote that experience to the advancement of the mechanic arts through the medium of The Franklin Institute. His contributions to science were notable; his personality as well as his unfailing good sense made him an agreeable associate and a wise counsellor. He is greatly missed.

Coleman Sellers, Jr., by tradition and through inheritance was deeply interested in the work of the Institute. Turning to the YEAR BOOK we find that Mr. Sellers and his forebears have occupied the positions of Manager, Vice-President and President of The Franklin Institute for a total of approximately eighty years,—four-fifths of the Institute's life. Through three generations the Sellers' family have been prominent in the work of the Institute. Those of us who knew Coleman Sellers, Jr., and were witnesses of the ability and good-will brought by him to the service of science can judge what a profound and beneficial influence must have been

the eighty years of the Sellers' participation in the Institute's work. Those of us who knew Coleman Sellers, Jr., in his relation to his fellow man realize that in his death the Institute has lost a wise and devoted counsellor, the Commonwealth a citizen of the finest type, and his personal friends a rare and lovable associate.

The principal item of interest in the report of the Committee on Endowment, Mr. Clamer, Chairman, is the statement that the Institute has received during the year from the Pennsylvania Company for Insurance on Lives and Granting Annuities, \$1,997.22—being the Institute's share in the further distribution of the estate of Harriet Blanchard, deceased, and making a total of \$57,549.00 received from the estate. The Committee also reports on the transfer of certain securities in connection with the settlement with the widow and daughters of Mr. Henry W. Bartol.

The Committee on Stocks and Finance, Mr. Forstall, Chairman, reports that the Institute's financial condition continues sound, although as generally during the Institute's life, our operating expenses have exceeded our operating revenue. The Board has anticipated this condition, and as they have told you from year to year they are not disturbed by it. The work of the Institute continues to cost more than the income of the Institute, less donations and bequests, affords. This cost, however, over a period of years, is much less than our regular income plus the occasional bequests and gifts applicable to operating expenses. We are continuing to carry on the work, spending what is necessary to the efficient conduct of the Institute's activities, in full confidence that in the future, as for the past ten or fifteen years, our total income applicable to operating expenses will continue to be larger than our total operating expenses. We have assured you before, and we assure you now, that while we are committing ourselves to the expenditures necessary for the proper conduct of our work, it is never to the extent of imperilling any creditor's interest or of using any trust funds other than as designated by their donors. We hope that this policy meets your approval, as it has met it in the past.

The difference between our so-called "regular income"—that is, income from all sources other than gifts and bequests—and our expenditures, is \$10,016.93, which is the so-called "deficit" from the year's operations. Aside from the Bartol bequest, the total of funds held by the Institute has increased approximately \$19,000.00, of which approximately \$16,000.00 was from interest earned on the Franklin Institute Building Fund.

The Committee on Library, Mr. Hall, Chairman, reports the addition to the library during the year of 1452 volumes and 1491 pamphlets. There were many gifts of books, pamphlets and magazines, notable among them a gift from Mr. F. H. Shelton of an unique and valuable collection of books and pamphlets on windmills. Included in Mr. Shelton's gift were several treatises on the subject printed in German and Dutch in the seventeenth and eighteenth centuries. Mr. Shelton also donated to the Institute two volumes in manuscript prepared by himself and a book containing 400 views of windmills in all parts of the world.

The funds at the disposal of the Library Committee—approximately

\$5,500.00 per year, are inadequate for the useful work that the Library Committee might accomplish in the purchase of books and the binding of volumes and pamphlets. For the present we must content ourselves with an annual expenditure approximating the above amount. As in previous years, we have to record that while our library attendance is small, due in part to the location of our building, it is to be noted, that a large proportion of the people who come to the library come to consult many books and often spend days in such consultation.

Such, in brief, is the history of the Institute's activities during the year ending September 30, last. In some respects the record is unique. Notable among its features is the precedent established by the visit of Dr. Aston, above referred to. Your Board confidently anticipates that the precedent so brilliantly established will be maintained and that in the future from year to year we will be able to present to the scientists of America, courses of lectures upon scientific matters of interest by the leading scientists of the world. We anticipate that Prof. J. J. Thomson will visit the Institute the coming spring for the delivery of a series of lectures upon "The Electron in Chemistry." We are enabled to arrange this through the generosity of friends in the electrical industry who give this additional evidence of their intelligent interest in scientific matters and in The Franklin Institute. The success of the Institute in carrying out its plans in this respect, bringing to the Institute some of the most inspiring personalities of the world of science, must result in a notable stimulation of the scientific life of America.

Members of The Franklin Institute: Our institution is about to enter on the last year of its first century of life. Through one hundred years, unaided by National, State or municipal support, the Institute has given efficient service in the promotion of physical science—in time of peace knowing no national boundaries, its only recognized frontier being the advanced line of scientific endeavor—in time of war bending every energy to the aid of the nation in arms. This is the example set for us by four generations of men. It becomes us in these latter months of the Institute's first century of existence to resolve to so continue its work during the fraction of its life under our influence that men in the expiring hours of other centuries, seeing our accomplishment in perspective, shall judge us to have been not unworthy custodians of the life and traditions of The Franklin Institute. In our time there must be no break in the line of honorable tradition.

Membership in our institution has its responsibilities as well as its privileges. A part of your responsibility as members is to make sure that the men you entrust with official position are men of such capacity and good intent as insures the maintaining of our century old standards. Not otherwise than by recognizing and meeting this responsibility can you justify your membership in this venerable and honorable institution. The Franklin Institute is worthy of the best. It is for you to see that it has the best. As of today its destinies are in your hands.

Respectfully submitted,

WALTON CLARK,
President.

PHILADELPHIA, January 17, 1923.

REPORT OF THE COMMITTEE ON LIBRARY

For the Fiscal Year Ending September 30, 1922.

To the President and Members of The Franklin Institute:

The Committee on Library respectfully submits the following statement of activities in the library during the year ending September 30, 1922.

The additions to the library were as follows:

| Source | Bound Volumes | Unbound Volumes | Pamphlets |
|-------------------------------|------------------|--------------------|-----------|
| By Gift | 420 | 284 | 1488 |
| Binding | 467 | | |
| Purchase | | | |
| Books and Periodicals Account | 8 | 2 | |
| Jayne Fund | 5 | 1 | |
| Journal | 34 | 13 | 2 |
| Lea Fund | 35 | 3 | |
| Levy Fund | 7 | 3 | 1 |
| Memorial Library Fund | 8 | | |
| Miscellaneous Expense Acct. . | 1 | 1 | |
| Moore Fund | 62 | 34 | |
| Morris Fund | 17 | | |
| Periodicals Completion Fund . | 15 | | |
| Potts Fund | 5 | 2 | |
| Ware Fund | 18 | 7 | |
| | <hr/> | <hr/> | <hr/> |
| | 1102 | 350 | 1491 |

Total additions for the year2943

An increase of forty-two titles over the preceding year.

The Committee had at its disposal \$3,250 appropriated by the Board of Managers and \$2,278.42, the income from the various trust funds.

The expenditures for the year were \$1,251.05 for binding, \$3,468.41 for books and subscriptions to magazines and other periodical publications and \$211.20 for general expenses.

Gifts of books, pamphlets, and magazines in large quantities or of special interest were received from Messrs. H. A. Freeman, F. A. Shelton, John C. Trautwine, Jr., Henry W. Wilson, The U. S. Metallic Packing Company, Mrs. George R. Henderson, Professor Lewis M. Haupt and the Engineers' Club of Philadelphia. Mr. Shelton's gift consisted of a unique collection of books and pamphlets on windmills including treatises on the subject in German and Dutch printed in the seventeenth and eighteenth centuries, also two volumes in manuscript prepared by Mr. Shelton and a book containing 400 views of windmills in all parts of the world. Mr. Shelton also presented a number of volumes on gas and gas manufacture.

The contents of the library on September 30, 1922 were:

| | |
|----------------------------------|--------|
| Volumes, bound and unbound | 77,364 |
| Pamphlets | 18,611 |
| Maps and Charts | 2,292 |
| Photographs | 1,349 |

Binding:

During the year the following work was done by the binders:

| | |
|---|-----------|
| Recent volumes of periodicals bound | 319 |
| 1134 pamphlets bound | 79 |
| Recent volumes of foreign chemical periodicals bound and charged to the Chemical Periodical Binding Fund | 33 |
| Volumes charged to the Morris Fund | 36 |
| Old volumes, bound and rebound | 57 |
| | <hr/> 524 |

Magazines and Other Periodical Publications:

6550 copies of the JOURNAL were used for exchange purposes.

Twenty-seven exchanges were added to the mailing list and one hundred and fifty-four were discontinued.

The total number of exchanges on September 30th was 459. The subscriptions totaled 172 and the number of gift subscriptions was 74, making the total number of periodical publications received, 705.

Evening Hours:

The library was open on twenty-eight meeting nights until ten o'clock, with a total attendance after six o'clock of 47 members.

Respectfully submitted,

CLARENCE A. HALL,
Chairman.

PHILADELPHIA, January 10, 1923.

REPORT OF THE COMMITTEE ON MUSEUM

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1922.

To the President and Members of The Franklin Institute:

The following models, apparatus and specimens have been added to the Institute's collection since the date of the last report:

Working model done to scale of the original Van Depoele tram-car, one of the earliest electrical lines to run in New England in the vicinity of Ansonia and Derby. It was capable of carrying twenty-five tons of freight. Presented by Mr. L. S. Storrs, President, The Connecticut Company, New Haven, Connecticut. A full description of this model appears in the Proceedings of the Stated Meeting of the Institute held November 16, 1921, (J. F. I., Vol. 192, page 819).

The first blanket of camels wool taken from the first loom erected in the

mill at Tien-Tsin, China, in February, 1900. Presented by Mr. R. A. Difenderfer of Elkins Park, Pennsylvania.

A specimen each of American white pine and American white oak being portions of the original timber used in the construction of the Trenton Bridge of the Delaware River, placed there in 1803 and removed in 1875 after seventy-two years of constant service. Presented by Mr. Henry W. Wilson, member of the Institute.

Seventeen samples of copals and gums used in the manufacture of varnish. Presented by Mr. Joseph R. Stulb, C. Schrack and Company, Philadelphia.

A 6-A economy gas cabinet stove made about 1885 by the American Meter Company of New York and Philadelphia. Presented by the Borden Stove Company of Philadelphia.

Five wooden clock movements, early 19th century. Presented by Mr. B. F. Schmauk, Philadelphia.

Twenty-two sheets of manuscript with original drawings of road-making and agricultural machinery, sailing vessels and apparatus for coast defense formerly the property of Dr. Thomas Ruston, a friend of General Washington. Presented by John F. Lewis, Esquire, Philadelphia.

Photograph of painting of Henry Morton by A. D. Turner. Original in the possession of the Stevens Institute of Technology. Presented by Dr. Alex. C. Humphreys. (Dr. Morton was the first Resident Secretary of The Franklin Institute, having served from 1865 to 1870.)

Mrs. George R. Henderson presented to the Institute the following apparatus formerly belonging to her husband, a member of the Institute's Board of Managers from 1915 to 1921:

- One four inch telescope,
- One spectroscope made by John Brashear,
- One case of direct reading hydrometers and thermometers,
- Two boxes of graduated scales,
- One Beck microscope with attachments,
- One set of drawing instruments,
- One micrometer (Brown and Sharpe),
- One draftsman's steel protractor,
- One hand level (Keuffel and Esser Company),
- One astronomical globe made by Mr. Henderson.

Respectfully submitted,

ALEX. E. OUTERBRIDGE, JR.,
Chairman.

PHILADELPHIA, January 10, 1923

REPORT OF THE COMMITTEE ON MEETINGS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1922.

To the President and Members of The Franklin Institute:

Eight stated meetings were held during the year ending September 30, 1922. These were held on the third Wednesday of each month, from October

to May inclusive, at the hour of eight o'clock, with the exception of that of May 17 which was held at three-thirty o'clock in the afternoon. The following is a list of dates and speakers with titles and synopses of their communications:

October 19, 1921: Ralph Modjeski, D. Eng., Chief Engineer, Delaware River Bridge Joint Commission, Philadelphia, Pennsylvania, member of the Institute presented a paper on "The Delaware River Bridge between Philadelphia and Camden." The speaker gave an account of the comparative study and considerations which led to the adoption of the suspension type of bridge and described the salient features and characteristics of the design. The subject was illustrated by lantern slides from the engineers' drawings and views of the bridge as it will appear when completed. The paper was printed in full in the January, 1922 issue of the JOURNAL.

At this meeting the Elliott Cresson Medal was presented to Dr. Byron E. Eldred of New York City for his invention of "Low Expansion Leading-in Wire for Incandescent Electric Lamps."

The Howard N. Potts Medal was presented to Mr. Alfred O. Tate, of Cranston, Rhode Island, for his process of water-proofing fabrics.

November 16, 1921: Heber D. Curtis, Ph.D., Director of the Allegheny Observatory, Pittsburgh, Pennsylvania, presented a paper on "The Spiral Nebulae and their Interpretation." The speaker pointed out that of all known classes of celestial objects, the spirals are perhaps the most difficult to fit into any coherent scheme of stellar evolution, either as a point of origin or as an evolutionary product. In form, in distribution, and in space velocity, they stand apart from all other objects observed in the Milky Way. Much modern observational evidence supports the belief that these beautiful objects are separate galaxies of stars, or "island universes," comparable with our own galaxy in size and in number of component suns. Evidence for and against the island universe theory of the spirals was presented. The subject was illustrated by lantern slides.

At this meeting Mr. L. S. Storrs presented to the Institute a beautifully constructed working model, done to scale, of the original Van Depoele motor.

The Edward Longstreth Medal was presented to His Excellency, James Hartness, Governor of Vermont, the inventor of the Hartness Screw Thread Comparator.

The Edward Longstreth Medal was also presented to Mr. Thomas Willing Hicks for his "Once-over" Tiller.

December 21, 1921: P. H. Bates, A.B., B.S., Chief, Structural and Miscellaneous Materials Division, Bureau of Standards, Washington, District of Columbia, presented a paper on "The Application of the Fundamental Knowledge of Portland Cement to Its Manufacture and Use."

The results of various attempts to determine the mineral constituents of Portland cement, culminating in the successful attempt of Rankin, were reviewed. The work of the Bureau of Standards in determining the physical properties of the different constituents was described. The relative amounts of these occurring in cement of normal manufacture, and the possibility and

economy of producing, in the process of manufacture, the determined amount of any constituent were discussed. The quality of cements of relatively the same composition but different constitution, the desirability of more refined methods of testing to determine the qualities not revealed by present tests and the need of cements of different qualities for different uses were also considered. The subject was illustrated by lantern slides. The paper was printed in full in the March, 1922 issue of the JOURNAL.

January 18, 1922: Honorable William D. B. Ainey, LL.D., L.H.D., Chairman of The Public Service Commission of Pennsylvania, presented a paper on "The Highway System of the State of Pennsylvania." Consideration was given to the subject of transportation as a factor in national development and the importance of highways as transportation means. An outline was given of the historical development of highway construction programs as well as the beginnings and accomplishments of the State Highway System. Brief reference was also made to the past, present and future bearing upon the economic conditions of the State. At the close of his remarks, the speaker called upon Mr. Harold E. Hilts, Assistant Engineer of the Construction Division, State Highway Department, who exhibited a series of lantern photographs of machinery and apparatus used in the construction of roads, as well as a number of views of completed roads in various parts of the state. He described materials used in road building and the methods of their application.

February 15, 1922: L. J. Briggs, M.S., Ph.D., Chief, Engineering Physics Division, Bureau of Standards, Washington, District of Columbia, presented a paper on "The Resistance of the Air." Wind-tunnels for obtaining air-streams of known velocity were described as well as aerodynamical balances for measuring air forces on a model; reference was made to the air-resistance equation and dynamical similarity in air-resistance measurements. Consideration was given to the air-resistance of bodies of various forms and to air-foils. Reference was also made to the problem of the measurement of the resistance of projectiles. The subject was illustrated by lantern slides.

March 15, 1922: M. deKay Thompson, Ph.D., Associate Professor of Electrochemistry, Massachusetts Institute of Technology, Cambridge, Massachusetts presented a paper on "Recent Progress in Applied Electrochemistry." An account was given of the recent progress in the different branches of electroplating, batteries, and the manufacture of numerous substances by electrolysis and electrothermic means. The subject was illustrated by lantern slides. This paper was printed in full in the June, 1922 issue of the JOURNAL.

April 19, 1922: William D. Harkins, Ph.D., Department of Chemistry, University of Chicago, Chicago, Illinois, presented a paper on "The Structure and Building of Atom Nuclei." The speaker stated that the atom seems to consist of a central positive nucleus which plays the part of the sun in the solar system surrounded by a system of negative planetary electrons. The number of these planetary electrons is equal to the charge on the nucleus.

If an atom loses one or more of its planetary electrons, it easily picks up other negative electrons and becomes restored to its initial condition.

However, if the nucleus is broken up, no known experimental means suffice to put it together again; so the atom is said to disintegrate only when the nucleus is broken apart.

The lightest of all atoms, that of hydrogen, consists of one hydrogen nucleus with one positive charge, or what will be termed a positive electron which carries practically all of the mass of the atom together with a planetary system consisting of one negative electron. All of the heavier or complex atoms seem to have nuclei which are built up from a number of positive electrons equal to the atomic weight, together with about half as many negative electrons which serve to bind them together.

The conditions under which an atom nucleus is stable were discussed. The principal stability conditions are very simple. The most stable nuclei contain an even number of both negative and positive electrons, the more important condition being that the number of negative electrons shall be even. Light atoms are in general more stable than heavy ones, though there are more types of heavy than of light atoms.

One of the most important of the stability conditions is that as the positive charge on the nucleus becomes larger the ratio of negative to positive charges in the nucleus must also become larger. That is, as the net positiveness of the nucleus increases the relative negativeness must also increase.

If the complete history of the building of atoms could be unfolded, it would undoubtedly be seen to be one of fundamental importance in determining the present condition of the stars, and also of the surface of the earth and the organisms which dwell upon it.

That elements may be split apart into isotopes has been found recently. The first isotopes separated, those of chlorine, were exhibited. The subject was illustrated by lantern slides, models and specimens. The publication of this paper was begun in the August issue of the JOURNAL and will appear in several succeeding issues.

At this meeting the Edward Longstreth Medal was awarded to Mr. Samuel T. Freas, of Trenton, New Jersey, for his "Interlocking" Tooth Saw.

The Edward Longstreth Medal was also presented to Mr. Joseph F. Keller, of Brooklyn, New York, for his Automatic Die Cutting Machine.

May 17, 1922: The Franklin Medal, accompanying Certificate, and Certificate of Honorary Membership were presented to Mr. R. L. Craigie, First Secretary of the British Embassy, for transmission to Sir Joseph John Thomson, Master of Trinity College, Cambridge, England, whose paper on "An Electron Theory of Solids" was read by Dr. Joseph S. Ames of the Johns Hopkins University, Baltimore, Maryland.

The Franklin Medal, accompanying Certificate, and Certificate of Honorary Membership were presented to Dr. Ralph Modjeski of New York City, who read a paper on "Bridges—Old and New."

A portrait of Dr. Walton Clark, painted in oil, by Mr. Lazar Raditz, was presented to the Institute by Mr. Nathan Hayward, member of the Board of Managers, on behalf of the Officers, Board of Trustees, and Board of Managers of the Institute.

The papers of Dr. Modjeski and Sir J. J. Thomson were printed in the September, 1922 issue of the JOURNAL, in which issue a full account of the meeting may also be found.

The attendance at these meetings totaled 947.

Respectfully submitted,

GELLERT ALLEMAN,
Chairman.

PHILADELPHIA, January 17, 1923.

REPORT OF THE COMMITTEE ON INSTRUCTION

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1922,

To the Board of Managers of The Franklin Institute:

The courses offered by The Franklin Institute School of Mechanic Arts in its ninety-eighth year, beginning in September, 1921, were the same as those given during the preceding year, namely, Mechanical Drawing, Architectural Drawing and Design, Freehand Drawing and Water Color, Shop Arithmetic and Algebra, Plane Geometry and Trigonometry, Applied Mechanics and Strength of Materials, Machine Design, Structural Design and Theoretical and Practical Naval Architecture.

The School opened on September 13, 1921, and during the year two hundred and ninety individual students were enrolled, one hundred and eighty-three less than the unusually large enrollment of the previous year. It is believed that this condition was largely due to the extreme industrial depression which continued throughout the year. The decrease in the registration was noticeable in each of the Departments of the School but it was most marked in the Department of Naval Architecture. The largest classes during the year were those in First Year Mechanical Drawing and First Year Mathematics.

The high grade of work done by the students and their regular attendance indicate that the School completed a satisfactory year. During the first term eighty-four students had a perfect attendance record and forty-one made an average of 90 per cent. or over. During the second term seventy students had a perfect attendance record and thirty-four made an average of 90 per cent. or over.

The faculty for the year was as follows:

Mr. Arthur J. Stretton, The Baldwin Locomotive Works, Mechanical Drawing.

Mr. I. P. Pedrick, William Sellers and Company, Incorporated, Mechanical Drawing.

Mr. G. W. H. Fawkes, of the University of Pennsylvania Faculty, Mechanical Drawing.

Mr. Clement Remington, Associated with Horace Trumbauer, Architect, Architectural Drawing.

Mr. Frederick C. Miller, of the Germantown High School Faculty, Mathematics.

Mr. H. H. Fox, of the Germantown High School Faculty, Mathematics.

Mr. W. Earl Neilson, Student in the Wharton School, University of Pennsylvania, Mathematics.

Mr. Bartram A. Owen, of the University of Pennsylvania Faculty, Applied Mechanics and Strength of Materials, and Structural Design.

Mr. B. W. Taylor, of the University of Pennsylvania Faculty, Machine Design.

Mr. B. B. Wood, William Cramp and Sons' Ship and Engine Building Company, Naval Architecture.

Mr. R. E. Brown, The New York Shipbuilding Corporation, Naval Architecture.

Mr. Wm. S. Owen, The New York Shipbuilding Corporation, Naval Architecture.

Mr. James G. Morgan, The New York Shipbuilding Corporation, Naval Architecture.

During the year, students of the School and members of the Alumni Association visited the following places of engineering interest:

The Otis Elevator Company, Philadelphia, Pennsylvania.

Morris Wheeler and Company, Philadelphia, Pennsylvania.

Sun Shipbuilding Company, Chester, Pennsylvania.

League Island Navy Yard, Philadelphia, Pennsylvania.

David Lupton's Sons Company, Philadelphia, Pennsylvania.

Sherritt and Stoer Company, Philadelphia, Pennsylvania.

DeLong Hook and Eye Company, Philadelphia, Pennsylvania.

The attendance at these visits was good and much interest was shown by those present. The representatives of the various establishments received the students most courteously and spared no effort to make the visits both interesting and instructive.

The graduating exercises were held in the Hall of the Institute on Friday evening, April 21, 1922. Dr. Walton Clark, President of the Institute, presided. The speaker of the evening was Rev. John H. Chapman. The Alumni Association was represented by Mr. James G. Morgan. Sixty-one students were graduated; ten in Mechanical Drawing, seven in Architectural Drawing, one in Freehand Drawing, twenty in Mathematics, twelve in Mechanics, and eleven in Naval Architecture.

On rising to confer the certificates, Dr. Clark made the following remarks to the graduates:

"Young Men, Members of the Class of 1922:

"We congratulate ourselves that The Franklin Institute has had a part in aiding you in your effort to achieve, through education, positions of greater usefulness to yourself and to others. We of the Institute realize that ours has been the smaller—though still a very important—part in the education of your hands and brains to greater skill, and as we hope, in the education of your hearts, to possibilities of greater happiness. We have offered you opportunity for study under skilled direction. You

have had the ambition to desire, and the courage and perseverance to utilize that opportunity to the full, and to such good purpose that competent men have pronounced you worthy to be named among the multitude of men, four generations of men, who before you have become graduates of The Franklin Institute. As graduates of the Institute, in some measure the honor of our venerable institution, now yours and ours, is in your hands. We who are more directly responsible for the direction of the Institute's affairs, welcome this Class of 1922, confident that in adding you to our Alumni we increase the capacity of the Institute for good and make more certain for it a long and useful career. As we part from you as students we welcome you as friends and as supporters of the work begun by our devoted predecessors one hundred years ago.

"Young men, 'The rose of youth is upon you and men will expect something in particular.'"

The following scholarships were awarded:

Six B. H. Bartol Scholarships.

Six Isaac B. Thorn Scholarships.

The Siegler Prize, founded by the late John H. Siegler, Esq., in his will dated February 21, 1918 was awarded to Samuel E. Lieberman, a student in Mathematics.

Two students were awarded prizes in the Department of Drawing: The prize donated by Mr. Robert W. Lesley, member of the Institute's Board of Managers was presented to the student of greatest merit in Architectural Drawing and the prize given by Mr. Samuel M. Vauclain, President, The Baldwin Locomotive Works was awarded to the student of greatest merit in Mechanical Drawing.

To the most meritorious student in the Department of Mathematics, was awarded, a prize donated by Mr. J. B. McCall, President of The Philadelphia Electric Company. A prize donated by Mr. Wilfred Lewis, President, The Tabor Manufacturing Company, was awarded to a meritorious student in the Department of Mechanics. A valuable set of drawing instruments, donated by The New York Shipbuilding Corporation, was awarded to the student of greatest merit in the Department of Naval Architecture. Six students received awards provided by the Alumni Association of The Franklin Institute School of Mechanic Arts and twenty-six, having a perfect attendance record, were awarded free membership for one year in the Association. Certificates of Honorable Mention were awarded to forty-six students for excellent work and regularity in attendance during the year.

The graduates were invited to the annual reunion and dinner of the Alumni Association, held on the evening of Saturday, April 22, 1922. At the dinner sixty covers were laid and addresses were made by Dr. George A. Hoadley, representative of the Board of Managers of The Franklin Institute, and by Edwin M. Abbott, Esq.

During the summer the School Calendar for the session of 1922-23 was published, 3000 copies of which and 1000 posters were distributed in such a way as seemed likely to reach the greatest number of possible students.

A schedule of visits to engineering establishments, including the Belmont Pumping Station and Filtering Plant of Philadelphia, was arranged. Visits to ice plants and ice cream manufacturing establishments are also contemplated.

Respectfully submitted,

LAWRENCE T. PAUL,
Chairman.

PHILADELPHIA, January 10, 1923

REPORT OF THE COMMITTEE ON ELECTION AND RESIGNATION OF MEMBERS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1922.

To the Board of Managers of The Franklin Institute:

During the fiscal year ending September 30th, 1922 forty-four new members were enrolled in all classes of membership; resignations were received and accepted from thirty-seven members; and deaths of twenty-three members were recorded.

The detail as to elections, resignations, and deaths for the three years ending September 30, 1922 is as follows:

ELECTIONS:

| | 1919-20 | 1920-21 | 1921-22 |
|-----------------------------|---------|---------|---------|
| Resident Members | 32 | 30 | 24 |
| Non-Resident Members | 19 | 35 | 12 |
| Associate Members | 11 | 5 | 3 |
| Honorary Members | 2 | 3 | 3 |
| Corresponding Members | 3 | 0 | 0 |
| Life Members | 0 | 2 | 2 |
| Second Class Stock | 0 | 0 | 0 |
| | — | — | — |
| | 67 | 75 | 44 |

RESIGNATIONS:

| | | | |
|----------------------------|----|----|----|
| Resident Members | 19 | 9 | 17 |
| Non-Resident Members | 14 | 14 | 20 |
| Associate Members | 0 | 1 | 0 |
| Second Class Stock | 0 | 0 | 0 |
| | — | — | — |
| | 33 | 24 | 37 |

DEATHS:

| | | | |
|----------------------------|----|----|----|
| Resident Members | 6 | 8 | 8 |
| Non-Resident Members | 8 | 6 | 11 |
| Life Members | 8 | 14 | 3 |
| Honorary Members | 1 | 0 | 1 |
| Associate Members | 0 | 0 | 0 |
| Second Class Stock | 0 | 1 | 0 |
| | — | — | — |
| | 23 | 29 | 23 |

SUMMARY:

| | | | |
|---------------------------------------|----|----|----|
| Elections | 67 | 75 | 44 |
| Resignations | 33 | 24 | 37 |
| Dropped for non-payment of dues | 27 | 16 | 19 |
| Deaths | 23 | 29 | 23 |
| Net decrease in membership | | 35 | |

Membership of the Institute by Classes, September 30th, 1922.

| | |
|----------------------------------|------|
| Resident Members | 510 |
| Non-Resident Members | 559 |
| Life Members | 203 |
| Honorary Members | 26 |
| Associate Members | 26 |
| Second Class Stock Members | 24 |
| Corresponding Members | 3 |
| Total | 1351 |

A decrease of thirty-five was recorded in the membership of the Institute for the year ending September 30th, 1922 but this change does not have much significance. In 1912 the number of members was increased from 1130 to 1344 approximately 20%, due to special effort on the part of your Committee. The average membership for the period 1912-1922 was 1380 and at no time during this period was there a variation of more than 3% from this average.

As greater interest is being created in the work of the Institute due in part to the proposed Bartol Research Foundation Laboratory, it is believed that this is a favorable time to enlarge the membership of the Institute. Through members and other friends of the Institute, your Committee is planning to invite those who might be interested in the Institute's activities to submit application for membership.

Respectfully submitted,

R. W. LESLEY,
Chairman.

PHILADELPHIA, January 10, 1923.

REPORT OF THE COMMITTEE ON STOCKS AND FINANCE

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1922.

To the Board of Managers of The Franklin Institute:

The Committee presents the following financial statement:

PROPERTY AND FUNDS

| | | |
|---|------------------|-------------------|
| Building and Land, 13-17 South Seventh Street.... | \$60,000.00 | |
| Library | 100,000.00 | \$160,000.00 |
| | | <i>Unexpended</i> |
| | <i>Principal</i> | <i>Income</i> |
| Funds held by Board of Trustees.... | \$629,713.77 | \$1,864.35 |
| Funds held by Board of Managers... | 157.23 | |
| Franklin Institute Building Fund... | 538,782.03 | |
| Elliott Cresson Medal Fund..... | 3,000.00 | 796.56 |
| Franklin Fund and Building Committee | 25,288.94 | |
| Total Funds | \$1,196,941.97 | \$2,660.91 |
| | | \$1,199,602.88 |
| Grand Total | | \$1,359,602.88 |

LIABILITIES

| | |
|-----------------------------|-------------|
| Certificates of Stock | \$29,040.00 |
| Bills Payable | 20,000.00 |
| Vouchers Payable | 3,579.88 |
| Unearned Income | 8,840.60 |
| | \$55,460.48 |

INCOME AND EXPENSES APPLICABLE TO YEAR ENDED SEPTEMBER 30, 1922.

Income:

| | |
|--------------------------------------|-------------|
| Dues—Resident | \$7,447.50 |
| Nonresident | 2,945.00 |
| Second Class Stock | 288.00 |
| Associate | 120.00 |
| | \$10,800.50 |
| Initiation Fees | 90.00 |
| Harriet Blanchard Legacy | 1,997.22 |
| H. Belfield Memorial Fund | 268.82 |
| James H. Cresson Memorial Fund | 2,267.92 |
| General Endowment Fund | 20,380.36 |
| John H. Wahl Fund | 4,473.34 |
| Lewis S. Ware Library Fund | 600.00 |
| Estate of John Turner | 148.42 |

| | | |
|--|------------|-------------|
| Estate of Robert Wright | | 1,840.57 |
| Instruction—Drawing | \$1,658.00 | |
| Mathematics | 1,562.00 | |
| Mechanics | 712.50 | |
| Naval Architecture | 510.00 | 4,442.50 |
| Publications—Subscriptions and Sales | \$3,048.65 | |
| Advertising | 3,197.79 | |
| Reprints | 294.49 | 6,540.93 |
| Miscellaneous Income and Expense | | 647.16 |
| Total | | \$54,506.74 |

EXPENSES

| | | |
|--|-------------|-----------|
| Building—Wages | \$1,931.62 | |
| Repairs and Maintenance | 1,231.63 | |
| Taxes, Water Rent and Insurance | 486.97 | |
| Heat, Light and Power | 1,123.10 | |
| Miscellaneous Supplies and Expense | 405.63 | 5,178.95 |
| Instruction—Drawing | \$2,247.00 | |
| Mathematics | 732.25 | |
| Mechanics | 840.00 | |
| Naval Architecture | 1,008.00 | |
| Salaries and Annuities | 1,833.36 | |
| Miscellaneous Expense | 715.41 | 6,376.02 |
| Library—Salaries | \$7,475.61 | |
| Books and Periodicals | 1,987.52 | |
| Binding | 1,147.25 | |
| Miscellaneous Expense | 211.20 | 10,821.58 |
| Meetings | | 1,364.64 |
| Office and General—Salaries | \$13,304.39 | |
| Office Expense | 1,222.53 | |
| General Expense | 1,361.68 | |
| Auditor and Treasurer | 899.94 | 16,788.54 |
| Publications—Printing | \$13,725.59 | |
| Illustrating | 2,474.33 | |
| Miscellaneous Expense | 523.50 | |
| Year Book | 902.34 | 17,625.76 |
| Science and Arts | | 3,992.69 |
| Sections | | 2,043.41 |

| | |
|-------------------------------|-------------------------|
| Interest and Discount | 299.08 |
| Badges and Certificates | 33.00 |
| Total | <hr/> \$64,523.67 <hr/> |
| Deficit | \$10,016.93 |

There was an addition of \$28,586.08 during the year in the principal of funds held by the Institute. This consisted, mainly, of \$15,790.50 added to The Franklin Institute Building Fund by accretions of income, and of \$10,000 added to the fund in the possession of the Franklin Fund and Building Committee by writing on as an asset of that Committee, the \$10,000 note held by it for money loaned the Institute and always carried as a liability of the Institute but never hitherto as an asset of the Committee, and therefore of the Institute.

Respectfully submitted,

WALTON FORSTALL,
Chairman.

PHILADELPHIA, January 10, 1923.

REPORT OF THE COMMITTEE ON PUBLICATIONS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1922

To the Board of Managers of The Franklin Institute:

The one hundred and ninety-fourth volume of the JOURNAL will be completed when this report is presented. This and the preceding volume will include a record of the activities of the Institute during the ninety-eighth year of its existence.

The papers published in the JOURNAL have consisted in large part of the lectures delivered before the Institute and its sections with a number of original communications from specialists of acknowledged authority in their respective lines of activity.

The notices of the results of recent research, furnished to the JOURNAL by the Bureau of Standards and the other leading research laboratories throughout the country, have appeared from month to month in its pages.

The eleventh volume of the Year Book, issued during the current year, contains the report of the President of the Institute and of its various standing committees with such other information as may be of interest to our membership. The practice of distributing this volume among the scientific associations and technical societies at home and abroad, as a means of increased publicity for the Institute, is being continued.

The demand for the work on the "Physics of the Air" by Dr. W. J. Humphreys continues. Twelve hundred fifty-four copies have been sold since the work was first issued less than two years ago. The very flattering press notices which have appeared indicate that the book is one which is of extreme value to meteorologists and aviators.

The expenses of the Committee for the year are as follows:

| | |
|-----------------------------|-------------|
| Printing | \$13,725.59 |
| Illustrations | 2,474.33 |
| Year Book | 902.34 |
| Miscellaneous Expense | 523.50 |

| | |
|-------------|-----------|
| Total | 17,625.76 |
|-------------|-----------|

Acknowledgements are again due to our Associate Editors for their valuable cooperation during the year.

Respectfully submitted,

GEORGE D. ROSENGARTEN,
Chairman.

PHILADELPHIA, January 17, 1923.

REPORT OF THE COMMITTEE ON EXHIBITIONS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1922.

To the Board of Managers of The Franklin Institute:

The Committee on Exhibitions has kept in touch with the Sesqui-Centennial Exhibition Committee, the Chairman of the Committee on Exhibitions of The Franklin Institute having been Chairman of the Civil Engineering Committee of the Engineers Club of the Sesqui-Centennial, but owing to the fact that the Sesqui-Centennial movement has not yet taken definite shape and no meeting having been called, no actual progress has been made, but as soon as the Sesqui-Centennial Exhibition is assured, it is recommended that the Franklin Institute Committee on Exhibitions get in close touch with the Sesqui-Centennial Exhibition Committee and endeavor to cooperate as energetically as possible.

Respectfully submitted,

BENJAMIN FRANKLIN,
Chairman.

PHILADELPHIA, January 10, 1923.

REPORT OF THE COMMITTEE ON SECTIONAL ARRANGEMENTS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1922.

To the Board of Managers of The Franklin Institute:

During the year ending September 30, 1922, nineteen meetings were conducted by the several sections of the Institute.

Section of Physics and Chemistry: Fifteen meetings.

October 6, 1921: Joseph S. Ames, Ph.D., LL.D., Professor of Physics, The Johns Hopkins University, Baltimore, Maryland, and Director, Office of Aeronautical Intelligence, National Advisory Committee for Aeronautics, presented a communication on "Aeronautic Research." The three types of aircraft—airplane, airship, and helicopter—were described. Scientific prob-

lems, which arise in connection with the various types, were mentioned; and the mode of solution was outlined. An account was given of wind-tunnel experiments and actual flying tests. The lecture was illustrated with lantern slides. The paper appeared in full in the January, 1922 issue of the *JOURNAL*.

October 13, 1921: William Duane, A.M., Ph.D., Professor of Biophysics in Harvard University, Cambridge, Massachusetts presented a paper on "X-ray Spectra and Crystal Structure." The methods for the measurement of x-ray spectra with precision were described. The general character of, and the experimental relations between, continuous, line and x-ray absorption spectra were discussed. An account was given of the evidence obtained through the x-rays concerning the structure of crystals and of atoms, the mechanism of radiation, the quantum law, and the theory of relativity. In conclusion, stress was placed on the importance of spectrum analysis in medical applications of the x-rays. The lecture was illustrated with lantern slides.

October 27, 1921: Henry Leffmann, A.M., M.D., Ph.D., D.D.S., Lecturer on Research in the Philadelphia College of Pharmacy and Science, presented a communication on "The Application of the Microscope to Research." An account was given of the use of color screens, polarized light, photography with ordinary and special plates, and the staining of minute objects. The lecture illustrated with lantern slides was printed in full in the January, 1922 issue of the *JOURNAL*.

November 10, 1921: Albert W. Hull, Ph.D., of the Research Laboratory of the General Electric Company, Schenectady, New York, read a paper on "The Crystal Structures of the Common Elements." A description was given of the apparatus for the analysis of crystals by means of the x-rays. The available data on this subject were reviewed and summarized. The lecture was illustrated with lantern slides. The paper was printed in the February, 1922 issue of the *JOURNAL*.

December 1, 1921: Eugene T. Allen, Ph.D., Research Chemist, Geophysical Laboratory of the Carnegie Institution of Washington, District of Columbia presented a communication entitled, "Chemical Aspects of Volcanism," in which the origin of volcanic gases and the factors influencing their chemical composition were discussed. The subject was illustrated by lantern slides. The paper was printed in the January, 1922 issue of the *JOURNAL*.

December 8, 1921: E. A. Eckhardt, Ph.D., Chief of the Sound Section, Bureau of Standards, Washington, District of Columbia, read a paper on "The Precise Measurement of Small Time Intervals." An account was given of the recent developments of the methods of and facilities for measuring small time intervals. The applicability of apparatus and methods to both scientific and industrial purposes was discussed. The applications to the measurement of linear and angular velocities and accelerations, vibration frequencies, etc., were described. The subject was illustrated by lantern slides.

December 15, 1921: Erskine D. Williamson, A.M., B.S., Physical Chemist, Geophysical Laboratory, Carnegie Institution of Washington, District of Columbia, presented a paper on "Change of the Physical Properties of Materials with Pressure." The apparatus used to obtain hydrostatic pressures as high as 150,000 pounds per square inch was described. A resumé was given of the changes in certain fundamental electrical and elastic constants produced by the application of high pressures. The lecture was illustrated with lantern slides and a model of the apparatus. The paper was printed in the April, 1922 issue of the JOURNAL.

January 5, 1922: W. J. Humphreys, C.E., Ph.D., Professor of Meteorological Physics, United States Weather Bureau, Washington, District of Columbia, read a paper on "Fogs and Clouds." The principal types of fogs and clouds were discussed and their mode of formation and significance explained. Interesting facts were given concerning the size of fog and cloud particles; the number of them per given volume; why the air as a whole is never saturated; how clouds float, and how rain is produced; how the altitudes and velocities of clouds are measured; and other such matters concerning these fascinating phenomena of the sky. The subject was illustrated by numerous lantern slides. The lecture was printed in the February and March, 1922 issue of the JOURNAL.

January 12, 1922: Ralph R. McKee, Ph.D., Professor of Chemical Engineering in Columbia University, New York City, read a communication on "Gasoline from Oil Shale." The possible American sources of motor fuel were considered. The American deposits of oil shale, the destructive distillation of such shale, and the production of gasoline from the crude distillate were described. The lecture was illustrated with lantern slides and with specimens of typical oil shales and shale oils. This paper was printed in the March, 1922 issue of the JOURNAL.

February 9, 1922: L. J. Henderson, M.D., Professor of Biological Chemistry in Harvard University, Cambridge, Massachusetts, presented a paper on "Applications of Physical Chemistry to the Physiology of Breathing." The respiration changes in the blood were described; and an account was given of the various factors which control the transport of oxygen and carbon dioxide in the blood stream and produce an extremely complex chemical equilibrium. The subject was illustrated by lantern slides.

February 23, 1922: Hugh S. Taylor, Sc.D., Associate Professor of Physical Chemistry in Princeton University, Princeton, New Jersey, presented a communication on "Catalysis and Catalytic Agents in Chemical Processes." The general feature of catalysis and catalytic agents were described. It was shown that chemical reactions may be produced more rapidly and more efficiently when such agencies are employed. The principles and methods of investigation of catalytic problems were next outlined more especially in reference to unsolved problems. The form of the catalytic agent, catalyst poisons and promoters were discussed. Theories of catalytic action were reviewed. The important technical catalytic processes were outlined, including the manufacture of sulphuric acid and ammonia; the oxida-

tion of ammonia and other gases; hydrogenation processes and the hardening of liquid fats; processes of hydrolysis, including the production of soaps and alcohol; applications in the fine chemical industry and in electrochemistry. The subject was illustrated by exhibits, experiments and lantern slides. This paper was printed in the July, 1922 issue of the JOURNAL.

March 2, 1922: Colonel E. Lester Jones, A.M., Director of the United States Coast and Geodetic Survey and Commissioner, International Boundary, United States-Alaska and Canada, read a paper on "Surveying from the Air." The standard surveying methods of the United States Coast and Geodetic Survey were described; and the history of aerial surveying was outlined. An account was given of the aerial surveys of Atlantic City, the Coast of New Jersey and the delta of the Mississippi River. The subject was illustrated with lantern slides. This paper was printed in the April, 1922 issue of the JOURNAL.

March 23, 1922: R. B. Moore, Sc.D., Chief Chemist, Bureau of Mines, United States Department of the Interior, Washington, District of Columbia, presented a paper on "Low Temperature Research and the Cryogenic Laboratory of the Bureau of Mines." A resumé was given of the history of the liquefaction of gases with special reference to air, hydrogen, and helium. The application of low temperature work to physical constants and to the knowledge of the constitution of matter was described. The lecture was illustrated by lantern slides and experiments.

April 6, 1922: E. W. Washburn, Ph.D., Department of Ceramics, University of Illinois, Urbana, Illinois, read a communication on "Physical Chemistry and Ceramics." The application of the methods of physical chemistry to the solution of various problems in the field of ceramics was described. The subject was illustrated by lantern slides. The paper was printed in the June, 1922 issue of the JOURNAL.

April 13, 1922: K. T. Compton, Ph.D., Professor of Physics in Princeton University, Princeton, New Jersey, presented a communication on "The Physics of the Three-Electrode Bulb." The Edison and thermionic effects were demonstrated; the properties of thermionic currents, the theories of thermionic emission, and the characteristics of evacuated and gas-filled bulbs were described. The paper was illustrated by means of lantern slides and experiments.

Electrical Section: Three Meetings.

November 3, 1921: Fred H. Albee, A.M., Sc.D., M.D., of New York City, New York, read a paper on "The Use of Electric Machine Tools in Bone Surgery." The evolution of surgical instruments for the cutting of bone was traced; and an account was given of the construction and use of the automatic machine tools devised by Dr. Albee for use in bone surgery. The tools were exhibited and lantern slides and moving pictures were used to illustrate the subject.

February 2, 1922: L. W. Austin, Ph.D., D.Sc., Head, U. S. Naval Radio Research Laboratory, Bureau of Standards, Washington, District of Columbia, presented a paper on "Recent Development in Radio Communication." Atten-

tion was given to the recent development in and the present status of long distance radio communication; its methods, its problems and difficulties, its reliability and limitations; with the laws of transmission and their experimental verification. Facts were presented regarding the principal high power stations of the world now in operation or under construction. Announcement was made of plans for long distance communication, and with long distance radio in the future. The subject was illustrated with lantern slides. The paper was printed in the April, 1922 issue of the Journal.

March 30, 1922: Harvey Fletcher, Ph.D., of the Research Laboratory of the American Telephone and Telegraph Company and Western Electric Company, Incorporated, New York City, New York, presented a communication on the "Nature of Speech and Its Perception." The relative importance of various frequency ranges in spoken sounds was discussed and illustrated by experiments. For experimental purposes the spoken sounds were translated into the electrical form. The electrical communication circuit used was the most nearly perfect ever devised. Electric wave filters were employed to eliminate at will various parts of the scale of speech frequencies. The intelligibility, characteristic of any condition of speech communication, was determined by test employing scientifically chosen syllables. The experimental results given exhibited in quantitative terms the effects of using limited ranges of frequency to transmit speech. The data were analyzed so that the specific action upon each vowel and consonant was plainly evident. The evidence thus obtained would seem to demand a modification of the present theories of speech. The subject was illustrated by numerous experiments and lantern slides.

Mechanical and Engineering Section: One Meeting.

April 27, 1922: Frank Sprague, D.Eng., D.Sc., President of the Sprague Safety Control and Signal Corporation, New York City, New York, presented a paper on "Automatic Train Control." The speaker described railroad operation of the United States which is mainly carried on under three methods of control—train orders, manual blocking and automatic block signals—the last of which is the most modern and adds measurably to the safety and efficiency of operation. Despite these facts, up to the present, it has been adopted on less than one-third of the trunk line mileage of the country.

This system is based upon the division of the tracks into blocks of various lengths, each fully or partly insulated from the other and supplied with current at its far end to normally energize a relay at the near end. These relays—active or not according as the blocks are occupied—control a system of motor-operated way-side signals inter-connected in such a manner that they are made to show "danger," "caution" or "clear" indications, according to track conditions.

But these signals are after all but directional in character, and to be effective must be seen, understood and obeyed by the engineer. Experience has shown that these three essential conditions often are not met, from any

one of many evident causes, and as a consequence disastrous end-on collisions not infrequently occur.

To overcome this defect in the present system of railroad operation many kinds of "automatic stops" and "automatic train controls" have been proposed, designed to protect the train in the event of failure of the engineer, but a satisfactory solution of the problem, that is, one which while affording ample protection will at the same time leave the engineer under all normal conditions in control of his train is a difficult one.

The paper dealt with a specific development based upon the use of track magnets under control of the signal relay, to establish cab signals and to initiate the required braking, which system is being subjected to intensive tests on the New York Central Railroad. This system is based on the same track fundamentals as is the automatic signal system and can be used either independently of it, that is, with cab signals only, or in connection with the wayside signals to combine them and the braking system of the train. The paper was printed in the August, 1922 issue of the JOURNAL.

The attendance at these meetings totaled 1968.

Dr. F. W. Aston, F.R.S., Fellow of Trinity College, Cambridge, England, delivered a series of lectures on "Atomic Weights and Isotopes" in the lecture hall of the Institute on the afternoons of March 6th to 10th inclusive.

The first lecture was delivered on the afternoon of Monday, March 6th, at 3:30 o'clock. Mr. Coleman Sellers, Jr., Vice-president of the Institute, welcomed Dr. Aston, and Dr. Arthur W. Goodspeed, Professor of Physics, University of Pennsylvania, M.F.I., presided. The subject of this lecture was "The Atomic Nature of Matter" and the following is a brief synopsis:

The atomic structure of matter generally; ancient speculation. "Is matter infinitely divisible?" Views of Newton and the early chemists. Dalton's atomic theory. Size and number of atoms illustrated by repeated subdivisions of a cube of lead. Relative delicacy of methods for the detection of elements. Modern methods of detection of single atoms.

Dr. Augustus Trowbridge, Professor of Physics, Princeton University, M.F.I., presided at the second lecture on Tuesday, March 7th. Subject "Discharge of Electricity in Gases." Special attention was given the following:

Nature of low-pressure discharge. Crookes' dark space, its length at different pressures in various gases, variation with current intensity. Primary dark space. Distribution of potential in the Crookes' dark space. Failure of theories suggested. Cathode rays and positive rays.

Mr. W. H. Fulweiler, Chief Chemist, United Gas Improvement Company, Philadelphia, M.F.I., presided at the third lecture on Wednesday, March 8th. Subject, "Positive Rays and Their Analysis." Special attention was given to the following:

Sir J. J. Thomson's parabola method of analysis of positive rays. First proof of the approximate identity of weights of atoms of the same element. Abnormal chemical compounds. Triatomic hydrogen. Neon and its para-

bolos. Attempts to separate its components. Failure of fractional distillation, success of diffusion experiments. Analogy to Soddy's radioactive isotopes.

"The Mass-spectrograph" was the subject of the lecture on Thursday afternoon. The following topics were considered:

Problem of increasing the accuracy of positive ray analysis. Methods of focussing the rays. Principle of the mass-spectrograph. Details of its construction and experimental technic. Standard lines. Lines of the first, second and higher orders. Mass-spectra of the chemical elements neon, chlorine, etc. Remarkable results with krypton, xenon and mercury. Mass-spectra of the alkali metals. Isotopes and the periodic law.

Dr. Joseph S. Ames, Director of the Physical Laboratory, Johns Hopkins University, Baltimore, M.F.I., presided.

The closing lecture of the series on "Isotopes and the Structure of the Atom" was given on Friday afternoon. The following topics were considered:

The whole number rule. Abnormality of hydrogen. Method of measuring masses of hydrogen and helium by "bracketing." The electrical structure of atoms, protons and electrons. The Rutherford atom and its later development by Bohr and Langmuir. The spectra of isotopes. Their chemical identity and its probable explanation. Separation of isotopes. Possible methods. Work of Bronsted and Hevesy. Suggested explanation of the constancy of the composition of chemical elements and conjectures as to their evolution.

Dr. Arthur L. Day, Geophysical Laboratory, Washington, D. C., M.F.I., presided.

Physicists and Chemists were in attendance from all parts of the Eastern, Southern and Midwestern States and Canada.

A paper by Doctor Aston, giving a summary of these lectures, appeared in the JOURNAL for May, 1923.

At the conclusion of his course of lectures Dr. Aston also addressed audiences at Columbia, Princeton, Harvard, McGill, Johns Hopkins, Cornell Universities, the University of North Carolina, The Scientific Societies of Washington, District of Columbia, The General Electric Company, Schenectady, New York, and the Engineers' Club, New York City.

Dr. Aston has recently been awarded the Nobel prize in chemistry.

Respectfully submitted,

HARRY F. KELLER,
Chairman.

PHILADELPHIA, January 10, 1923.

REPORT OF COMMITTEE ON ENDOWMENT

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1922.

To the Board of Managers of The Franklin Institute:

Your Committee has been chiefly engaged during the year with the settlement of the Henry W. Bartol Estate and final settlements were made with Lucy Cheyney Farr and Katherine de Monclos, daughters of Mr. Bartol. Funds to the amount of \$300,000.00, \$150,000.00 for each of the daughters, were assigned out-right to them and turned over to their representatives. Trust funds in like amount, in which the daughters have only a life interest, were received and deposited with the Girard Trust Company as agent for The Franklin Institute. These trust funds will revert to the Institute at the death of these ladies.

In order that trust funds created under the Will of Henry W. Bartol, deceased, may be kept separate from the other funds of the Institute, securities and other assets which the Institute has or receives from time to time as beneficiary under the Will, are being designated in the full name of the Institute with the sub-title Bartol Research Foundation.

The French Estate of Mr. Bartol has not been settled and the value of the Institute's interest in it is not definitely known. The attorneys handling this case for the Institute have been requested to effect settlement as soon as possible.

The principal of funds other than the Bartol bequest, held by the Institute, was increased during the year in the amount of \$28,586.08. This consisted mainly of \$15,790.50 added to The Franklin Institute Building Fund by accretions of income, and of the \$10,000.00 added to the fund in the possession of The Franklin Fund and Building Committee by writing on as an asset of that Committee the \$10,000.00 note held by it, for money loaned the Institute and always carried as a liability of the Institute but never hitherto as an asset by the Committee, and therefore, of the Institute. No additions were made to the Institute's funds during the year through gift or bequest.

On February 28th, a check for \$1,997.22 was received from the Pennsylvania Company for Insurance on Lives and Granting Annuities, being the Institute's share in the final distribution of the Estate of Harriet Blanchard, deceased, and making a total of \$57,549.00 received from this Estate.

Respectfully submitted,

G. H. CLAMER,
Chairman.

PHILADELPHIA, January 10, 1923.

REPORT OF THE COMMITTEE ON SCIENCE AND THE ARTS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1922.

To the President and Members of The Franklin Institute:

The year just closing was the eighty-eighth in which the Committee on Science and the Arts has rendered service to the Institute. During this

year the Committee has investigated and made final disposition of eighteen cases and fourteen are now pending.

The reading of the appendix of this report will show the scope of the activities of the Committee in its investigations, the subjects including many fields of scientific investigation and industrial application.

Fifteen of the eighteen cases investigated received awards.

The Standing Sub-Committee on The Franklin Medal and the Standing Sub-Committee on Literature met as required during the year and on their recommendation the awards shown in the appended statement were made.

The Sub-Committee on New Subjects and Preliminary Examination met each month and considered fifty-six subjects. Applications were received covering eleven of these subjects and Sub-Committees of Investigation were appointed. The work of this Sub-Committee is of great value since by its examinations it invites the attention of the Committee to suitable subjects for investigation and prevents unsuitable ones from coming to its attention.

Recipients of awards were invited to attend the Stated Meetings of the Institute to receive the awards from the hands of the President and in many cases these invitations were accepted.

Two Franklin Medals were presented at the May Meeting, one to Dr. Ralph Modjeski and one to Professor J. J. Thomson. After a statement by Dr. Joseph S. Ames, of Johns Hopkins University, concerning the work of Professor Thomson, Master of Trinity College, Cambridge, England, in physical science, the medal awarded to Professor Thomson was received by R. L. Craigie, First Secretary of the British Embassy of Washington. Mr. Craigie in accepting the medal and diploma for transmission to Professor Thomson, said in part: "It is a great privilege to be present on this important occasion and to accept, on behalf of Sir Joseph John Thomson, the beautiful Medal and the Certificate of Honorary Membership which The Franklin Institute has bestowed upon him. To meet the members of this famous institution of learning is in itself an event which I prize highly. To accept from you a token of honor bestowed upon a scientist whom we hold in the highest esteem and for whom there is world-wide admiration marks the occasion as one of special significance."

Appended is an account from the London *Times* of July 27, 1922, of the presentation of the Franklin Medal to Sir J. J. Thomson by the Earl of Balfour.

The work of Dr. Ralph Modjeski, of New York City, New York, in the designing and building of bridges was described by Dr. Onward Bates, of Chicago, Illinois, who presented Dr. Modjeski to Dr. Walton Clark, the President of the Institute. Dr. Modjeski in accepting the medal and diploma said: "It is not possible for me to frame adequate words to express my appreciation of the two great honors which you are conferring upon me. The more I feel, the less I can say, so please just let me say I thank you."

Dr. Ames then read the paper on "An Electron Theory of Solids" prepared by Sir J. J. Thomson for the occasion and Dr. Modjeski presented a paper on "Bridges Old and New."

The attendance at the Stated Meetings of the Committee on Science and the Arts has been most satisfactory. The dinners preceding the meetings have been well attended and serve to make those who attend, better acquainted as well as to give an opportunity for the discussion of questions pertaining to the work of the Committee.

A detailed statement of the work of the Committee during the past year is appended.

Respectfully submitted,

JAMES BARNES,
Chairman.

APPENDIX.

STATEMENT OF THE COMMITTEE'S OPERATION FOR THE

YEAR ENDING SEPTEMBER 30, 1922.

| | |
|-------------------------------------|----|
| Cases pending October 1, 1921 | 16 |
| Applications during the year | 11 |
| Special Reports | 5 |
| | — |
| | 32 |
| Disposed of during the year | 18 |
| Leaving pending | 14 |

AWARDS MADE

| | |
|------------------------------------|----|
| Franklin Medal Awards | 2 |
| Howard N. Potts Awards | 3 |
| Edward Longstreth Awards | 5 |
| Certificates of Merit Awards | 5 |
| | — |
| | 15 |

AWARDS MADE DURING THE YEAR

THE FRANKLIN MEDAL

Dr. Ralph Modjeski, of New York City, New York, "in recognition of his signal achievements as a designer and builder of structures, mainly bridges, many of them epoch-marking in the history of the engineering profession, beautiful as well as useful, involving on the part of the designer, vision, courage and technique of the highest order."

Professor J. J. Thomson, Master of Trinity College, Cambridge, England, "in recognition of the immeasurable service he has rendered to the world as teacher and leader of thought in that domain of science especially related to a fundamental knowledge of electricity and the constitution of matter."

THE HOWARD N. POTTS MEDAL

E. G. Coker, University of London, England, for his Method of Determining Stress by Photo-Elastic Means.

Charles Raymond Downs, of New York, jointly with John Morris Weiss, of New York, for his inventions embodied in the Vapor Phase Oxidation of Benzene to Maleic Acid.

Richard B. Moore, Bureau of Mines, Washington, D. C., for his paper entitled "Helium, Its History, Properties and Commercial Development," in the JOURNAL.

John Morris Weiss, of New York, jointly with Charles Raymond Downs of New York, for his inventions embodied in the Vapor Phase Oxidation of Benzene to Maleic Acid.

THE EDWARD LONGSTRETH MEDAL

Samuel T. Freas, of Trenton, New Jersey, for his "Interlocking" Tooth Saw.

James Hartness, of Springfield, Vermont, for his Screw Thread Comparator.

Thomas Willing Hicks of Minneapolis, Minnesota, for his "Once-Over" Tiller.

Joseph F. Keller, of Brooklyn, New York, for his Automatic Die Cutting Machine.

Martin F. Tiernan, of Newark, New Jersey, jointly with Charles F. Wallace, for his inventions embodied in the Chlorinator.

Charles F. Wallace, of Newark, New Jersey, jointly with Martin F. Tiernan, for his inventions embodied in the Chlorinator.

CERTIFICATE OF MERIT

Rear Admiral W. H. G. Bullard, of Washington, D. C., for his paper entitled "The Application of Radio to Navigation Problems," in the JOURNAL.

Harry Etchells of Sheffield, England, jointly with H. A. Greaves, for his inventions embodied in the Electric Arc Furnace.

Walter Kidde and Company of New York, for Improved System of Detecting and Extinguishing Marine Fires.

Charles E. Mendenhall, of Madison, Wisconsin, for his paper entitled "Aeronautic Instruments," in the JOURNAL.

Arthur H. Pitney, of Stamford, Connecticut, for his Postage Meter.

APPENDIX—2.

TIMES (LONDON) JULY 27, 1922

SIR JOSEPH THOMSON

HONORED

Brotherhood of Science

Sir Joseph Thomson, O.M., F.R.S., yesterday received the Franklin Gold Medal, presented to him by The Franklin Institute, Philadelphia, "for signal and eminent service in science." The presentation was made by Lord Balfour at the Department of Scientific and Industrial Research, Old Queenstreet, Westminster, and the ceremony was attended by many of the leading figures in the scientific world on both sides of the Atlantic.

Lord Balfour said that in honoring Sir Joseph Thomson the Franklin Institute had not merely conveyed a signal sense of their estimate of Sir Joseph's merits as an individual, but they had conferred an honor upon the country where he was born and where he had done all the great work that had given him the distinguished place he occupied without contest among the scientific celebrities of the world. He (Lord Balfour) was sorry to say he was old enough to remember the giants who rendered physics illustrious in this country in the second half of the nineteenth century. He knew Lord Kelvin well; he knew others of his great Cambridge contemporaries; and their fame was not likely to be shaken by any discoveries which their successors might be fortunate enough to make. Yet he thought he would be borne out by all those competent to speak when he said that the last decade of the last century and successive years of the twentieth century would always be remembered in the history of physical and mathematical science as some of the most fruitful and epoch making the world had ever known. (Cheers.)

Physical research had penetrated into regions never hitherto explored, and he well remembered that Lord Kelvin, who had himself done so much to prepare the new epoch, was nevertheless almost shocked by some of the theories which had now been accepted universally as representing the most recent advances in physical science. One of the greatest of pioneers in this greatest of scientific movements was Sir Joseph Thomson. (Cheers.) What he had done in physics, in electricity as a department of physics, in the structure of the atom, in all those investigations which were proving day by day more and more fruitful, which were opening up such astonishing and unimagined vistas into the truths of Nature, and the full importance of which only future generations would be able adequately to estimate—to all these great performances it would take far more time than they had at their disposal, and far more knowledge than he (Lord Balfour) pretended to possess, to do anything like justice.

Sir Joseph Thomson said there was something besides a personal element in the bestowal of that honor—there was a contribution to the brotherhood of science between America and Britain. (Cheers.) He valued especially the association of the medal with the name of Franklin. He knew nothing quite analogous to Franklin's achievement in scientific history, for he obtained his immortal position practically by six years' work. He did it by sheer force of intellect, and he came to it without any scientific training. He had to the end of his life no mathematics. In fact, he was afraid Franklin classed mathematics and classics as things which it was quite undesirable to retain in a general scheme of education. (Laughter.) The writing of Franklin's contemporaries seemed out of date today, but not so Franklin's, and the striking thing about all his scientific work was that he appeared to regard it as a mere episode in his career to which he paid little importance. To find a man who had done work of the highest rank in so many subjects as Franklin, they had to go back to Leonardo da Vinci.

Among those present were:—

Mr. H. Goold, representing the American Ambassador, Sir C. Sherington (President), Sir David Prain (Treasurer), Mr. W. B. Hardy (Secretary), Sir Aubrey Strahan and Professor A. Harden, representing the Royal Society, Dr. Elwell Hendricks, representing the Society of Chemical Industry of New York and the American Chemical Society, Professor T. H. Goodspeed, Berkeley, U. S. A., Professor W. G. McCallum, Baltimore, U. S. A., Professor R. F. Ruttan, Canadian Advisory Council, and the following members of the Advisory Council of the Department of Scientific and Industrial Research:—Sir William McCormick (chairman), Professor J. B. Farmer, Sir George Beilby, Sir R. Threlfall, Professor S. Young, Sir J. F. C. Snell, Professor J. F. Thorpe, Sir H. Miers, and Sir H. Frank Heath (Secretary).

THE FRANKLIN INSTITUTE AWARDS

OCTOBER, 1922 TO JUNE, 1923

THE FRANKLIN MEDAL

TO

General G. Ferrié, Paris, France, "in recognition of his long-continued and successful researches in the field of radio-transmission of intelligence and their splendid and successful military applications, and of his eminent success in the organization and directing of the communication service of the French Army during the World War."

Dr. Albert A. Michelson, "in recognition of his numerous and signally fruitful researches in physical science, especially his brilliant discoveries in the fields of optics and astrophysics."

THE ELLIOTT CRESSON MEDAL

TO

Lee de Forest, Jersey City, New Jersey, for his inventions embodied in the Audion.

Raymond D. Johnson, New York City, N. Y., for his inventions embodied in the Johnson Hydraulic Valve.

Albert Kingsbury, Philadelphia, Pennsylvania, for his inventions embodied in the Kingsbury Thrust Bearing.

THE HOWARD N. POTTS MEDAL

TO

Albert W. Hull, Schenectady, New York, for his paper entitled "The Crystal Structure of the Common Elements."

THE EDWARD LONGSTRETH MEDAL

TO

Edward J. Brandt, Watertown, Wisconsin, for his inventions embodied in the Brandt Automatic Cashier.

Noiseless Typewriter Company, New York, for the inventions and improvements embodied in the Noiseless Typewriter.

A. H. Pfund, Baltimore, Maryland, for his inventions embodied in his Colorimeter, Cryptometer, Paint Film Gauge and Rotating Sector.

Société Genevoise, Geneva, Switzerland, for the inventions embodied in the Universal Measuring Machine.

THE CERTIFICATE OF MERIT

TO

Harry R. Maxon, Muncie, Indiana, for his inventions embodied in the Maxon Pre-Mix Burner.

P. Lecomte du Nouy, New York City, N. Y., for his inventions embodied in the Surface Tension Apparatus.

AWARDS

1835-1923

FRANKLIN MEDAL AWARDS.

1915-1923.

ARRHENIUS, SVANTE AUGUST, PH.D., M.D., D.Sc., LL.D.

"In recognition of his notable contributions to the theory of physical science which have found unprecedentedly extended and fruitful application in the experimental study of chemical, physical, biological and cosmic phenomena, as well as in industrial chemistry."

1920.

CARTY, JOHN J., D.ENG., D.Sc., LL.D., D.S.M.

"In recognition of his long-continued activities in the telephone service, his important and varied contributions to the telephone art, his work in the establishment of the principles of telephone engineering, and his signal success in directing the efforts of a large staff of engineers and scientists to the accomplishment of the telephonic transmission of speech over vast distances."

1916.

DEWAR, SIR JAMES, LL.D., D.Sc., PH.D., F.R.S.E., F.I.C., F.C.S.

"In recognition of his numerous and most important contributions to our knowledge of physical and chemical phenomena and his great skill and inventive genius in attacking and solving chemical and physical problems of the first magnitude."

1919.

EDISON, THOMAS ALVA, PH.D., D.Sc., LL.D.

"In recognition of the value of numerous basic inventions and discoveries forming the foundation of world-wide industries, signally contributing to the well-being, comfort and pleasure of the human race."

1915.

FABRY, CHARLES, D.Sc.

"In recognition of his numerous and highly important contributions in the field of physical science, particularly the solution of optical and spectroscopical problems of fundamental importance."

1921.

FERRIÉ, AUGUSTE GUSTAVE, GENERAL.

"In recognition of his long-continued and successful researches in the field of radio-transmission of intelligence and their splendid and success-

YEAR BOOK OF

for military applications and of his eminent success in the organization and directing of the communication service of the French Army during the World War."

1923.

LENTZ, HENDRIK ANTOON, PH.D., F.R.S.

"In recognition of his researches which have so largely contributed to laying on a new foundation our knowledge of the nature of light and in developing our ideas concerning the ultimate construction of matter."

1917.

MONTE, GUGLIELMO, LL.D., D.Sc.

"In recognition of his brilliant inception and successful development of the application of magneto-electric waves to the transmission of signals and telegrams without the use of metallic conductors."

1918.

EDENHALL, THOMAS CORWIN, PH.D., D.Sc., LL.D., F.A.G.S.

"In recognition of his fruitful and indefatigable labors in physical research, particularly his contributions to our knowledge of physical constants and electrical standards."

1918.

SHELSON, ALBERT A., PH.D., Sc.D., LL.D.

"In recognition of his numerous and signally fruitful researches in physical science especially his brilliant discoveries in the fields of optics and astrophysics."

1923.

LESKI, RALPH, D.ENG.

"In recognition of his signal achievements as a designer and a builder of structures, mainly bridges, many of them epoch-marking in the history of the engineering profession, beautiful as well as useful, involving on the part of the designer, vision, courage and technique of the highest order."

1922.

ES, HEIKE KAMERLINGH, PH.D., D.Sc.

"In recognition of his long-continued and indefatigable labors in low-temperature research, which have enriched physical science, not only with a great number of new methods and ingenious devices, but also with achievements and discoveries of the first magnitude."

1915.

SONS, SIR CHARLES ALGERNON, K.C.B., C.B., M.A., LL.D., D.Sc., F.R.S.

"In recognition of his epoch-marking success in the development of the steam turbine, which has revolutionized the art of steam engineering, particularly in regard to the propulsion of mercantile and naval vessels and the driving of electrical generators."

1920.

RICHARDS, THEODORE WM., A.M., PH.D., SC.D., LL.D., CHEM.D., M.D., F.C.S.
"In recognition of his numerous and important contributions to inorganic, physical and theoretical chemistry, and particularly his classical series of redeterminations of the atomic weights of the more important chemical elements."

1916.

SPRAGUE, FRANK J., D.ENG.

"In recognition of his many and fundamentally important inventions and achievements in the field of electrical engineering, notably his contributions to the development of the electric motor and its application to industrial purposes, and in the art of electric traction, signally important in forming the basis of world-wide industries and promoting human welfare."

1921.

SQUIER, GEORGE OWEN, K.C.M.G., D.S.M., PH.D.

"In recognition of his valuable contributions to physical science, his important and varied inventions in multiplex telephony and telegraphy and in ocean cabling and his eminent success in organizing and directing the air and signal services of the U. S. Army in the World War."

1919.

TAYLOR, DAVID WATSON, D.ENG., D.S.M.

"In recognition of his fundamental contributions to the theory of ship resistance and screw propulsion and of his signal success in the application of correct theory to the practical design of varied type of war vessels in the United States Navy."

1917.

THOMSON, SIR JOSEPH JOHN, O.M., F.R.S., D.Sc., F.R.S.E., LL.D., PH.D.

"In recognition of the immeasurable service he has rendered to the world as teacher and leader of thought in that domain of science especially related to a fundamental knowledge of electricity and the constitution of matter."

1922.

CRESSON MEDAL AWARDS

1856-1923

ACKER, C. E.

Process of Manufacturing Caustic, etc.—1902.

ALBERT, CHARLES F.

Violins and Bows.—1887.

AMERICAN COTTON COMPANY.

Round Lap Bale System.—1901.

AMERICAN PAPER BOTTLE COMPANY.

Paper Bottles for Various Purposes.—1906.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY.

Contributions to the Modern Telephone Art.—1916.

ATWATER, W. O., and ROSA, E. B.

Respiration Calorimeter.—1900.

AUTOMATIC ELECTRIC COMPANY.

Automatic Telephony.—1910.

BAEYER, J. F. A. VON.

Research Work in Organic Chemistry.—1912.

BALDWIN LOCOMOTIVE WORKS.

Contributions to the Evolution of the American Locomotive.—1907.

BATCHELLER, C. H.

Compound Locomotive.—1893.

BATES, STOCKTON; SHAW, EDWIN, and VON CULIN, G. M.

Spindle Support.—1891.

BELL, ALEXANDER GRAHAM.

Electrical Transmission of Speech.—1912.

BERLINER, EMILE.

Telephony and Sound Reproduction.—1913.

BEVINGTON, J. H.

Welding Metal and Spinning and Shaping Tools.—1891.

BILGRAM, HUGO.

Bevel Gear Cutter.—1887.

BONWILL, W. G. A.

Electro-Magnetic Dental Mallet.—1876.

BORSCH, LOUIS.

Solid Invisible Bifocal Lens.—1907.

BOWER, HENRY.

Inodorous Glycerine.—1878.

BRASHEAR, JOHN A.

Leading Work in Astronomic Science.—1910.

CASTNER, H. Y.

Electrolytic Process of Decomposing Alkaline Chlorides for the Production of Caustic and Chlorine.—1807.

CHADOT, CYPRIEN.

Shoe Sewing Machine.—1885.

CHAMBERS BROTHERS.

Bolt and Rivet Clipper.—1878.

CHARLTON, J.

Shaft Coupling.—1876.

CLAMER, G. H.

Methods of Eliminating Metals from Mixture of Metals.—1904.

COOPER-HEWITT, P.

Mercury Rectifier.—1910.

CORSCADEN, T.

All-Wrought Steel Belt Pulley.—1898.

COWLES, EUGENE H., AND ALFRED, H.

Electric Smelting Furnace.—1887.

COWPER, EDWARD A., AND ROBERTSON, T. HART.

Writing Telegraph.—1889.

CROOKES, SIR WILLIAM.

Discoveries in Chemistry.—1912.

CURIE, PROF. AND MADAME.

Researches Resulting in the Discovery of Radium.—1909.

DEFOREST, LEE.

The Audion.—1922.

DELANDTSHEER, NORBERT.

Machine for Treating Flax.—1879.

DELANY, P. B.

Synchronous Multiplex Telegraphy.—1886.

DELANY, P. B.

System of Machine Telegraphy.—1896.

DELANY, P. B.

Telepost.—1908.

DIESEL, R.

Diesel Motor.—1901.

DODGE, J. M.

System of Storing Coal.—1904.

DUDLEY, P. H.

Dynamograph.—1877.

EDER, J. MARIA.

Researches in Photochemistry.—1914.

ELDRED, BYRON E.

Low-Expansion Leading-in Wire for Incandescent Electric Lamps.—1921.

EMMET, WILLIAM LEROY.

Work on Electrical Propulsion of Ships and Prime Movers.—1920.

FERRILL, J. L.

Process of Fireproofing Wood.—1903.

FISCHER, EMIL.

Contributions to Organic Chemistry.—1913.

FISKE, B. A.

Range Finder.—1892.

FISS, BARNES, ERBEN & Co.

Worsted Yarns.—1875.

FORBES, JOHN S., AND WATERHOUSE, A. G.

Art of Automatically Heating and Sterilizing Fluids.—1901.

FRITZ, JOHN.

Advancement of Steel Industries.—1910.

- GAEDE, W.
Molecular Air Pump.—1909.
- GANS, ROBERT.
Permutit.—1916.
- GAYLEY, J.
Dry Air Blast in Blast Furnace Operation.—1909.
- GILL, W. L.
School City.—1903.
- GOLDSCHMIDT, HANS.
Alumino-thermics.—1904.
- GOLDSCHMIDT, V.
New Theory of Musical Harmony.—1903.
- GRAY, E.
Telautograph.—1897.
- GRAY NATIONAL TELAUTOGRAPH COMPANY.
Telautograph.—1912.
- GRISCOM, W. WOODNUTT.
Electric Motor and Battery.—1881.
- HADFIELD, ROBERT A.
Advancement of Metallurgical Science.—1910.
- HAMMER, W. J.
Historic Collection of Incandescent Electric Lamps.—1906.
- HAMMOND, J.
Typewriter.—1890.
- HAUPT, L. M.
Reaction Breakwater.—1901.
- HAYES, MAYER AND COMPANY.
Manufacture of Files.—1890.
- HEANY, J. ALLEN.
Fireproof Insulated Wire.—1907.
- HERSCHEL, CLEMENS.
Venturi Meter.—1898.
- HOLLERITH, H.
Electric Tabulating Device.—1890.
- HOLMES, P. H.
Lubricant Bearing.—1892.
- HOUGH, R. B.
Contributions to the Characteristics and Uses of the American Woods.—
1908.
- HOWE, H. M.
Experimental Research on Steel.—1895.
- HOWE, H. M.
Metallurgy of Steel.—1892.

- IVES, FREDERICK E.
Color Photography.—1893.
- JENKINS, C. FRANCIS.
"Phantoscope."—1898.
- JOHNSON, RAYMOND D.
Hydraulic Valve.—1923.
- KINGSBURY, ALBERT.
Thrust Bearing.—1923.
- LANSTON, T.
Monotype Machine.—1896.
- LEVY, L. E.
Acid Blast Method and Apparatus for Etching Metal Plates.—1900.
- LEVY, L. E.
Machine for Powdering Plates for Etching.—1904.
- LEWIS, COL. ISAAC NEWTON.
Machine Gun.—1918.
- LINDE, KARL P. G.
Refrigeration Processes.—1914.
- LOWE, THADDEUS S. C.
Water Gas Process and Apparatus.—1886.
- LOVEKIN, L. D.
Expanding and Flanging Machinery and Tools for all Classes of Tubes.—
1904.
- LUMIÈRE, AUGUSTE AND LOUIS.
Color Photography.—1909.
- MALLET, A.
Articulated Compound Locomotive.—1908.
- MARKS, G. E.
Improvements in Artificial Limbs.—1893.
- MASON AND HAMLIN COMPANY.
Liszt Organ.—1901.
- MERGENTHALER, O.
Linotype.—1889.
- MICHELSON, A. A.
Work in Physical Optics.—1912.
- MOISSAN, HENRI.
Investigations with the Electric Furnace.—1898.
- MORLEY, E. W.
Determination of Fundamental Magnitudes in Chemistry.—1912.
- NOBLE, ALFRED.
Achievements in Civil Engineering.—1912.

NORTHROP, EDWIN F.

Electric Furnace and High Temperature Investigations.—1917.

OLSEN, TINIUS.

Testing Machine.—1891.

OTT AND BREWER.

China and Porcelain Wares.—1886.

OUTERBRIDGE, A. E. JR.

Molecular Structure of Cast Iron.—1904.

OWENS, MICHAEL J.

Bottle Blowing Machine.—1915.

PARKER, J. C.

Steam Generator.—1902.

PECKOVER, J.

Stone Sawing Machine.—1895.

PELTON, LESTER A.

Water Wheel.—1894.

PENCOYD IRON WORKS.

Bridge Construction.—1900.

PHILLIPS, F.

Pressed Steel Pulley for Power Transmission.—1907.

POWERS AND WEIGHTMAN.

Exhibit at The Franklin Institute Exhibition of 1874.—1875.

PRATT AND WHITNEY COMPANY.

System of Interchangeable Cut Gears.—1886.

PUPIN, M. I.

Art of Reducing Attenuation of Electrical Waves and Apparatus.—1905

RAMSAY, R. H.

Railway Car Transfer Apparatus.—1886.

RAMSAY, SIR WILLIAM.

Discoveries in Chemistry.—1913.

RANDOLPH, ISHAM.

Achievements in Civil Engineering.—1913.

RAYLEIGH, LORD.

Researches in Physical Science.—1913.

ROBERTSON, T. HART AND COWPER, ED. A.

Writing Telegraph.—1889.

ROENTGEN, W. C.

Investigations of a New Kind of Ray.—1897.

ROSCOE, SIR H. E.

Researches in Chemistry.—1912.

RUTHERFORD, ERNEST.

Advancement of Knowledge of Electrical Theory.—1910.

- SAUVER, A.
Metallography of Iron and Steel.—1910.
- SHAW, EDWIN; BATES, STOCKTON; VON CULIN, G. M.
Spindle Support.—1891.
- SHAW, THOMAS.
Automatic Device for Testing Mine Gases and System of Mine Signalling.—1887.
- SIMONDS, G. F.
Universal Rolling Machine.—1889.
- SMITH, EDGAR F.
Work in Electrochemistry.—1914.
- SPELLIER, LOUIS H.
Time Telegraph.—1881.
- SPRAGUE, F. J.
Multiple Unit System of Electric Traction.—1903.
- SQUIER, MAJOR GEO. OWEN.
Multiplex Telephony.—1912.
- STEINMETZ, C. P.
Application of Analytics to Electrical Engineering.—1913.
- STRATTON, S. W.
Leading Work in Metrology.—1912.
- TALBOT, B.
Open Hearth Steel Process.—1909.
- TATHAM, W. P.
Printing Press.—1875.
- TAYLOR, E. R.
Electric Furnace and Process of Manufacturing Bisulphide of Carbon.—1907.
- TAYLOR, FREDERICK W., AND WHITE, MAUNSEL.
Process of Treating Tool Steel.—1902.
- TESLA, NIKOLA.
Alternating Electric Currents of High Frequency.—1894.
- THOMSON, ELIHU.
Industrial Applications of Electricity.—1912.
- THOMSON, JOSEPH J.
Leading Work in Physical Science.—1910.
- TILGHMAN, B. C.
Sand Blast.—1875.
- TURNER, W. V.
Air Brake Design and Application.—1909.
- U. S. GEOLOGICAL SURVEY.
Exhibit of Survey.—1900.
- UNDERWOOD TYPEWRITER COMPANY.
Typewriter.—1909.

- VAUCLAIN, S. M.
Compound Locomotive.—1891.
- VERNAZ, ALEXIS.
Milling Files.—1909.
- VON CULIN, G. M.; BATES, STOCKTON; SHAW, E.
Spindle Support.—1891.
- WALKUP, L.
Air Brush.—1886.
- WATERHOUSE, A. G., AND FORBES, JOHN S.
Art of Automatically Heating and Sterilizing Fluids.—1901.
- WELSBACH, CARL AUER VON.
Incandescent Mantles.—1901.
- WESTON, EDWARD.
Leading Work in Electrical Discovery and Application.—1910.
- WHITE, MAUNSEL, AND TAYLOR, FREDERICK W.
Process of Treating Tool Steel.—1902.
- WILCKES, J.
"Econometer."—1898.
- WILEY, HARVEY W.
Leading Work in Agricultural Chemistry.—1910.
- WOOD, H. A. WISE.
Autoplate Machine.—1909.
- WRIGHT, ORVILLE.
Work in Aviation.—1914.
- YANKO, PAUL VON.
Piano Keyboard.—1893.
- ZENTMAYER, JOSEPH.
Microscopes and Objectives.—1875.

POTTS MEDAL AWARDS

1911-1923

- BARKER, WENDELL A.
Wrenchless Chuck.—1920.
- BIZZELL, JAMES A., AND LYON, T. L.
"Plants and Relation to Nitrate in Soils" (Paper).—1912.
- BONE, WILLIAM A.
"Surface Combustion" (Paper).—1913.
- BULLARD, EDWARD P., JR.
Mult-Au-Matic Machine Tool.—1920.
- COBLENTZ, W. W.
"Reflecting Power of Metals" (Paper).—1911.

COKER, E. G.

Method of Determining Stress by Photo-Elastic Means.—1922.

DAHLGREN, ULRIC.

"The Production of Light by Animals" (Paper).—1917.

DOWNS, CHARLES RAYMOND, AND WEISS, JOHN MORRIS.

Vapor Phase Oxidation of Benzene to Maleic Acid.—1922.

GRAY, ALEXANDER.

"Modern Dynamo Electric Machinery" (Paper).—1918.

HULL, ALBERT W.

"The Crystal Structure of the Common Elements" (Paper).—1923

HUMPHREYS, WILLIAM J.

"The Thunderstorm and Its Phenomena" (Paper).—1915.

JANNEY, REYNOLD, AND WILLIAMS, HARVEY D.

Hydraulic Speed Gear.—1919.

KENNELLY, A. E.

Linear Hot-Wire Anemometer.—1918.

KING, LOUIS V.

Improvements in Linear Hot-Wire Anemometers.—1918.

LANDRETH, CLARENCE P.

Direct Oxidation Process.—1919.

LYON, T. L., AND BIZZELL, JAMES A.

"Plants and Relation to Nitrate in Soils" (Paper).—1912.

MCCOLLUM, E. V.

"Nutrition and Physical Efficiency" (Paper).—1921.

MODJESKI, RALPH.

"Design of Large Bridges with Special Reference to Quebec Bridge" (Paper).—1914.

MOORE, RICHARD B.

"Helium, its History, Properties and Commercial Development" (Paper).—1922.

MURRAY, W. S.

"Conditions Affecting the Success of Main Line Electrification" (Paper).—1916.

TATE, ALFRED O.

Electrolytic Waterproofing of Textile Fabrics.—1921.

WEISS, JOHN MORRIS, AND DOWNS, CHARLES RAYMOND.

Vapor Phase Oxidation of Benzene to Maleic Acid.—1922.

WILLIAMS, HARVEY D., AND JANNEY, REYNOLD.

Hydraulic Speed Gear.—1919.

ful military applications, and of his eminent success in the organization and directing of the communication service of the French Army during the World War."

1923.

LORENTZ, HENDRIK ANTOON, PH.D., F.R.S.

"In recognition of his researches which have so largely contributed to laying on a new foundation our knowledge of the nature of light and in developing our ideas concerning the ultimate construction of matter."

1917.

MARCONI, GUGLIELMO, LL.D., D.Sc.

"In recognition of his brilliant inception and successful development of the application of magneto-electric waves to the transmission of signals and telegrams without the use of metallic conductors.'

1918.

MENDENHALL, THOMAS CORWIN, PH.D., D.Sc., LL.D., F.A.G.S.

"In recognition of his fruitful and indefatigable labors in physical research, particularly his contributions to our knowledge of physical constants and electrical standards."

1918.

MICHELSON, ALBERT A., PH.D., Sc.D., LL.D.

"In recognition of his numerous and signally fruitful researches in physical science especially his brilliant discoveries in the fields of optics and astrophysics."

1923.

MODJESKI, RALPH, D.ENG.

"In recognition of his signal achievements as a designer and a builder of structures, mainly bridges, many of them epoch-marking in the history of the engineering profession, beautiful as well as useful, involving on the part of the designer, vision, courage and technique of the highest order."

1922.

ONNES, HEIKE KAMERLINGH, PH.D., D.Sc.

"In recognition of his long-continued and indefatigable labors in low-temperature research, which have enriched physical science, not only with a great number of new methods and ingenious devices, but also with achievements and discoveries of the first magnitude."

1915.

PARSONS, SIR CHARLES ALGERNON, K.C.B., C.B., M.A., LL.D., D.Sc., F.R.S.

"In recognition of his epoch-marking success in the development of the steam turbine, which has revolutionized the art of steam engineering, particularly in regard to the propulsion of mercantile and naval vessels and the driving of electrical generators."

1920.

RICHARDS, THEODORE WM., A.M., PH.D., SC.D., LL.D., CHEM.D., M.D., F.C.S.

"In recognition of his numerous and important contributions to inorganic, physical and theoretical chemistry, and particularly his classical series of redeterminations of the atomic weights of the more important chemical elements."

1916.

SPRAGUE, FRANK J., D.ENG.

"In recognition of his many and fundamentally important inventions and achievements in the field of electrical engineering, notably his contributions to the development of the electric motor and its application to industrial purposes, and in the art of electric traction, signally important in forming the basis of world-wide industries and promoting human welfare."

1921.

SQUIER, GEORGE OWEN, K.C.M.G., D.S.M., PH.D.

"In recognition of his valuable contributions to physical science, his important and varied inventions in multiplex telephony and telegraphy and in ocean cabling and his eminent success in organizing and directing the air and signal services of the U. S. Army in the World War."

1919.

TAYLOR, DAVID WATSON, D.ENG., D.S.M.

"In recognition of his fundamental contributions to the theory of ship resistance and screw propulsion and of his signal success in the application of correct theory to the practical design of varied type of war vessels in the United States Navy."

1917.

THOMSON, SIR JOSEPH JOHN, O.M., F.R.S., D.Sc., F.R.S.E., LL.D., PH.D.

"In recognition of the immeasurable service he has rendered to the world as teacher and leader of thought in that domain of science especially related to a fundamental knowledge of electricity and the constitution of matter."

1922.

CRESSON MEDAL AWARDS

1856-1923

ACKER, C. E.

Process of Manufacturing Caustic, etc.—1902.

ALBERT, CHARLES F.

Violins and Bows.—1887.

AMERICAN COTTON COMPANY.

Round Lap Bale System.—1901.

AMERICAN PAPER BOTTLE COMPANY.

Paper Bottles for Various Purposes.—1906.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY.

Contributions to the Modern Telephone Art.—1916.

ATWATER, W. O., and ROSA, E. B.

Respiration Calorimeter.—1900.

AUTOMATIC ELECTRIC COMPANY.

Automatic Telephony.—1910.

BAEYER, J. F. A. VON.

Research Work in Organic Chemistry.—1912.

BALDWIN LOCOMOTIVE WORKS.

Contributions to the Evolution of the American Locomotive.—1907.

BATCHELLER, C. H.

Compound Locomotive.—1893.

BATES, STOCKTON; SHAW, EDWIN, and VON CULIN, G. M.

Spindle Support.—1891.

BELL, ALEXANDER GRAHAM.

Electrical Transmission of Speech.—1912.

BERLINER, EMILE.

Telephony and Sound Reproduction.—1913.

BEVINGTON, J. H.

Welding Metal and Spinning and Shaping Tools.—1891.

BILGRAM, HUGO.

Bevel Gear Cutter.—1887.

BONWILL, W. G. A.

Electro-Magnetic Dental Mallet.—1876.

BORSCH, LOUIS.

Solid Invisible Bifocal Lens.—1907.

BOWER, HENRY.

Inodorous Glycerine.—1878.

BRASHEAR, JOHN A.

Leading Work in Astronomic Science.—1910.

CASTNER, H. Y.

Electrolytic Process of Decomposing Alkaline Chlorides for the Production of Caustic and Chlorine.—1807.

CHADOT, CYPRIEN.

Shoe Sewing Machine.—1885.

CHAMBERS BROTHERS.

Bolt and Rivet Clipper.—1878.

CHARLTON, J.

Shaft Coupling.—1876.

CLAMER, G. H.

Methods of Eliminating Metals from Mixture of Metals.—1904.

COOPER-HEWITT, P.

Mercury Rectifier.—1910.

CORSCADEN, T.

All-Wrought Steel Belt Pulley.—1898.

COWLES, EUGENE H., AND ALFRED, H.

Electric Smelting Furnace.—1887.

COWPER, EDWARD A., AND ROBERTSON, T. HART.

Writing Telegraph.—1889.

CROOKES, SIR WILLIAM.

Discoveries in Chemistry.—1912.

CURIE, PROF. AND MADAME.

Researches Resulting in the Discovery of Radium.—1909.

DEFOREST, LEE.

The Audion.—1922.

DELANDTSHEER, NORBERT.

Machine for Treating Flax.—1879.

DELANY, P. B.

Synchronous Multiplex Telegraphy.—1886.

DELANY, P. B.

System of Machine Telegraphy.—1896.

DELANY, P. B.

Telepost.—1908.

DIESEL, R.

Diesel Motor.—1901.

DODGE, J. M.

System of Storing Coal.—1904.

DUDLEY, P. H.

Dynamograph.—1877.

EDER, J. MARIA.

Researches in Photochemistry.—1914.

ELDRED, BYRON E.

Low-Expansion Leading-in Wire for Incandescent Electric Lamps.—1921.

EMMET, WILLIAM LEROY.

Work on Electrical Propulsion of Ships and Prime Movers.—1920.

FERRILL, J. L.

Process of Fireproofing Wood.—1903.

FISCHER, EMIL.

Contributions to Organic Chemistry.—1913.

FISKE, B. A.

Range Finder.—1892.

FISS, BARNES, ERBEN & Co.

Worsted Yarns.—1875.

FORBES, JOHN S., AND WATERHOUSE, A. G.

Art of Automatically Heating and Sterilizing Fluids.—1901.

FRITZ, JOHN.

Advancement of Steel Industries.—1910.

- GAEDE, W.
Molecular Air Pump.—1909.
- GANS, ROBERT.
Permutit.—1916.
- GAYLEY, J.
Dry Air Blast in Blast Furnace Operation.—1909.
- GILL, W. L.
School City.—1903.
- GOLDSCHMIDT, HANS.
Alumino-thermics.—1904.
- GOLDSCHMIDT, V.
New Theory of Musical Harmony.—1903.
- GRAY, E.
Telautograph.—1897.
- GRAY NATIONAL TELAUTOGRAPH COMPANY.
Telautograph.—1912.
- GRISCOM, W. WOODNUTT.
Electric Motor and Battery.—1881.
- HADFIELD, ROBERT A.
Advancement of Metallurgical Science.—1910.
- HAMMER, W. J.
Historic Collection of Incandescent Electric Lamps.—1906.
- HAMMOND, J.
Typewriter.—1890.
- HAUPT, L. M.
Reaction Breakwater.—1901.
- HAVES, MAYER AND COMPANY.
Manufacture of Files.—1890.
- HEANY, J. ALLEN.
Fireproof Insulated Wire.—1907.
- HERSCHEL, CLEMENS.
Venturi Meter.—1898.
- HOLLERITH, H.
Electric Tabulating Device.—1890.
- HOLMES, P. H.
Lubricant Bearing.—1892.
- HOUGH, R. B.
Contributions to the Characteristics and Uses of the American Woods.—1908.
- HOWE, H. M.
Experimental Research on Steel.—1895.
- HOWE, H. M.
Metallurgy of Steel.—1892.

- IVES, FREDERICK E.
Color Photography.—1893.
- JENKINS, C. FRANCIS.
"Phantoscope."—1898.
- JOHNSON, RAYMOND D.
Hydraulic Valve.—1923.
- KINGSBURY, ALBERT.
Thrust Bearing.—1923.
- LANSTON, T.
Monotype Machine.—1896.
- LEVY, L. E.
Acid Blast Method and Apparatus for Etching Metal Plates.—1900.
- LEVY, L. E.
Machine for Powdering Plates for Etching.—1904.
- LEWIS, COL. ISAAC NEWTON.
Machine Gun.—1918.
- LINDE, KARL P. G.
Refrigeration Processes.—1914.
- LOWE, THADDEUS S. C.
Water Gas Process and Apparatus.—1886.
- LOVEKIN, L. D.
Expanding and Flanging Machinery and Tools for all Classes of Tubes.—1904.
- LUMIÈRE, AUGUSTE AND LOUIS.
Color Photography.—1909.
- MALLET, A.
Articulated Compound Locomotive.—1908.
- MARKS, G. E.
Improvements in Artificial Limbs.—1893.
- MASON AND HAMLIN COMPANY.
Liszt Organ.—1901.
- MERGENTHALER, O.
Linotype.—1889.
- MICHELSON, A. A.
Work in Physical Optics.—1912.
- MOISSAN, HENRI.
Investigations with the Electric Furnace.—1898.
- MORLEY, E. W.
Determination of Fundamental Magnitudes in Chemistry.—1912.
- NOBLE, ALFRED.
Achievements in Civil Engineering.—1912.

NORTHROP, EDWIN F.

Electric Furnace and High Temperature Investigations.—1917.

OLSEN, TINIUS.

Testing Machine.—1891.

OTT AND BREWER.

China and Porcelain Wares.—1886.

OUTERBRIDGE, A. E. JR.

Molecular Structure of Cast Iron.—1904.

OWENS, MICHAEL J.

Bottle Blowing Machine.—1915.

PARKER, J. C.

Steam Generator.—1902.

PECKOVER, J.

Stone Sawing Machine.—1895.

PELTON, LESTER A.

Water Wheel.—1894.

PENCOYD IRON WORKS.

Bridge Construction.—1900.

PHILLIPS, F.

Pressed Steel Pulley for Power Transmission.—1907.

POWERS AND WEIGHTMAN.

Exhibit at The Franklin Institute Exhibition of 1874.—1875.

PRATT AND WHITNEY COMPANY.

System of Interchangeable Cut Gears.—1886.

PUPIN, M. I.

Art of Reducing Attenuation of Electrical Waves and Apparatus.—1905

RAMSAY, R. H.

Railway Car Transfer Apparatus.—1886.

RAMSAY, SIR WILLIAM.

Discoveries in Chemistry.—1913.

RANDOLPH, ISHAM.

Achievements in Civil Engineering.—1913.

RAYLEIGH, LORD.

Researches in Physical Science.—1913.

ROBERTSON, T. HART AND COWPER, ED. A.

Writing Telegraph.—1889.

ROENTGEN, W. C.

Investigations of a New Kind of Ray.—1897.

ROSCOE, SIR H. E.

Researches in Chemistry.—1912.

RUTHERFORD, ERNEST.

Advancement of Knowledge of Electrical Theory.—1910.

- SAUVER, A.
Metallography of Iron and Steel.—1910.
- SHAW, EDWIN; BATES, STOCKTON; VON CULIN, G. M.
Spindle Support.—1891.
- SHAW, THOMAS.
Automatic Device for Testing Mine Gases and System of Mine Signalling.—1887.
- SIMONDS, G. F.
Universal Rolling Machine.—1889.
- SMITH, EDGAR F.
Work in Electrochemistry.—1914.
- SPELLIER, LOUIS H.
Time Telegraph.—1881.
- SPRAGUE, F. J.
Multiple Unit System of Electric Traction.—1903.
- SQUIER, MAJOR GEO. OWEN.
Multiplex Telephony.—1912.
- STEINMETZ, C. P.
Application of Analytics to Electrical Engineering.—1913.
- STRATTON, S. W.
Leading Work in Metrology.—1912.
- TALBOT, B.
Open Hearth Steel Process.—1909.
- TATHAM, W. P.
Printing Press.—1875.
- TAYLOR, E. R.
Electric Furnace and Process of Manufacturing Bisulphide of Carbon.—1907.
- TAYLOR, FREDERICK W., AND WHITE, MAUNSEL.
Process of Treating Tool Steel.—1902.
- TESLA, NIKOLA.
Alternating Electric Currents of High Frequency.—1894.
- THOMSON, ELIHU.
Industrial Applications of Electricity.—1912.
- THOMSON, JOSEPH J.
Leading Work in Physical Science.—1910.
- TILGHMAN, B. C.
Sand Blast.—1875.
- TURNER, W. V.
Air Brake Design and Application.—1909.
- U. S. GEOLOGICAL SURVEY.
Exhibit of Survey.—1900.
- UNDERWOOD TYPEWRITER COMPANY.
Typewriter.—1909.

- VAUCLAIN, S. M.
Compound Locomotive.—1891.
- VERNAZ, ALEXIS.
Milling Files.—1909.
- VON CULIN, G. M.; BATES, STOCKTON; SHAW, E.
Spindle Support.—1891.
- WALKUP, L.
Air Brush.—1886.
- WATERHOUSE, A. G., AND FORBES, JOHN S.
Art of Automatically Heating and Sterilizing Fluids.—1901.
- WELSBACH, CARL AUER VON.
Incandescent Mantles.—1901.
- WESTON, EDWARD.
Leading Work in Electrical Discovery and Application.—1910.
- WHITE, MAUNSEL, AND TAYLOR, FREDERICK W.
Process of Treating Tool Steel.—1902.
- WILCKES, J.
"Econometer."—1898.
- WILEY, HARVEY W.
Leading Work in Agricultural Chemistry.—1910.
- WOOD, H. A. WISE.
Autoplate Machine.—1909.
- WRIGHT, ORVILLE.
Work in Aviation.—1914.
- YANKO, PAUL VON.
Piano Keyboard.—1893.
- ZENTMAYER, JOSEPH.
Microscopes and Objectives.—1875.

POTTS MEDAL AWARDS

1911-1923

- BARKER, WENDELL A.
Wrenchless Chuck.—1920.
- BIZZELL, JAMES A., AND LYON, T. L.
"Plants and Relation to Nitrate in Soils" (Paper).—1912.
- BONE, WILLIAM A.
"Surface Combustion" (Paper).—1913.
- BULLARD, EDWARD P., JR.
Mult-Au-Matic Machine Tool.—1920.
- COBLENTZ, W. W.
"Reflecting Power of Metals" (Paper).—1911.

COKER, E. G.

Method of Determining Stress by Photo-Elastic Means.—1922.

DAHLGREN, ULRIC.

"The Production of Light by Animals" (Paper).—1917.

DOWNS, CHARLES RAYMOND, AND WEISS, JOHN MORRIS.

Vapor Phase Oxidation of Benzene to Maleic Acid.—1922.

GRAY, ALEXANDER.

"Modern Dynamo Electric Machinery" (Paper).—1918.

HULL, ALBERT W.

"The Crystal Structure of the Common Elements" (Paper).—1923

HUMPHREYS, WILLIAM J.

"The Thunderstorm and Its Phenomena" (Paper).—1915.

JANNEY, REYNOLD, AND WILLIAMS, HARVEY D.

Hydraulic Speed Gear.—1919.

KENNELLY, A. E.

Linear Hot-Wire Anemometer.—1918.

KING, LOUIS V.

Improvements in Linear Hot-Wire Anemometers.—1918.

LANDRETH, CLARENCE P.

Direct Oxidation Process.—1919.

LYON, T. L., AND BIZZELL, JAMES A.

"Plants and Relation to Nitrate in Soils" (Paper).—1912.

MCCOLLUM, E. V.

"Nutrition and Physical Efficiency" (Paper).—1921.

MODJESKI, RALPH.

"Design of Large Bridges with Special Reference to Quebec Bridge" (Paper).—1914.

MOORE, RICHARD B.

"Helium, its History, Properties and Commercial Development" (Paper).—1922.

MURRAY, W. S.

"Conditions Affecting the Success of Main Line Electrification" (Paper).—1916.

TATE, ALFRED O.

Electrolytic Waterproofing of Textile Fabrics.—1921.

WEISS, JOHN MORRIS, AND DOWNS, CHARLES RAYMOND.

Vapor Phase Oxidation of Benzene to Maleic Acid.—1922.

WILLIAMS, HARVEY D., AND JANNEY, REYNOLD.

Hydraulic Speed Gear.—1919.

LONGSTRETH MEDAL AWARDS

1890-1923

APPE, C.

"Meteorology" (Paper).—1913.

ABBOTT, ROBERT R.

"Modern Steels and Their Heat Treatment" (Paper).—1916.

ACHARD, F. H., KENNELLY, A. E., DANA, A. S.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—1917.

ADAMS, L. H., AND WILLIAMSON, E. D.

"The Annealing of Glass" (Paper).—1921.

ADAMS, W. G., AND FORBES, J. S.

Stop Valve for Radiators.—1893.

ALEXANDER, JOHN E.

"Phonosphere."—1905.

ALTENEDER, THEODORE AND SONS.

Drawing Pen.—1905.

ARMSTRONG, WM. T., AND COX, JACOB D.

Grip Socket.—1896.

ARNOLD, B. J.

Magnetic Clutches and System of Electric Power Station Construction.—1903.

AUSTIN, JOHN T.

Austin Organ.—1917.

BALL, JOHN D.

"Investigations of Magnetic Laws for Steel and Other Materials" (Paper).—1917.

BASKERVILLE, C.

"Chemistry of Anæsthetics" (Paper).—1912.

BATES, E. G.

Typographic Numbering Machine.—1895.

BAUSH, CHRISTIAN H.

Radial Drilling Machine.—1894.

BECKER, CHRISTOPHER A.

Chainomatic Balance.—1917.

BENNETT, CHARLES A.

Typewriter.—1909.

BERGONIE, J.

Use of A. C. Electro-Magnet in Surgery.—1921.

BLOEDE, V. G.

Process of Tinting Fabrics.—1894.

BONNELL, RUSSELL, AND SCHMITT, HENRY J.

Gate Valves.—1901.

BRADBURN AND PENNOCK.

Process of Obtaining Alumina from Bauxite.—1893.

BRANDT, EDWARD J.

Automatic Cashier.—1922.

BREED, G.

Apparatus for Producing Musical Sounds by Electricity.—1908.

BRISTOL, W. H.

Recording Pressure Gauge.—1894.

BROWN, HAROLD P., AND EDISON, THOMAS A.

Rail Bonds and Electrical Contacts.—1899.

CAFFREY, C. S., AND COMPANY.

Improvement in Carriages and Wagons.—1900.

CARTY, J. J.

Bridging Bell System.—1905.

CHAFFEE, E. L.

"Continuous Electric Oscillations" (Paper).—1913.

CHANCE, E. M.

"Pathogenic Mine Atmospheres" (Paper).—1912.

CHENEY, W. L.

Lathe Tool and Support.—1895.

CHENOWETH, A. C.

Method of Constructing Sewers.—1892.

CLARK, WM. H., AND COLLINS, FRANK W.

Cortlandt, Howe Ventilating Stove.—1894.

COLLINS, FRANK W. AND CLARK, WM. H.

Ventilating Stove.—1894.

COLT'S PATENT FIRE ARMS MANUFACTURING COMPANY.

Automatic Pistols.—1906.

COOPER, W. S.

Specimens of Aluminum Castings.—1895.

COX, JACOB D., AND ARMSTRONG, WM. T.

Grip Socket.—1896.

CREIGHTON, H. JERMAIN.

"The Deteriorating Action of Salt and Brine on Reinforced Concrete"
(Paper).—1918.

CRISFIELD, J. A. P.

Moisture Determinator for Coke and the Like.—1909.

CUMMINGS, H. H.

Speed Controllers.—1903.

CUSHMAN, ALLERTON S.

"Researches on the Corrosion of Iron and Steel" (Paper).—1908.

DANA, A. S., KENNELLY, A. E., ACHARD, F. H.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—
1917.

- DESHLER, CHARLES, AND McALLISTER, EDWARD J.
Portable Photometer.—1900.
- DEVOL, W. R.
Conduit Electric Railway.—1894.
- DODGE, WALLACE H.
Wooden Split Pulley.—1891.
- DOOLITTLE, T. B.
Hard Drawn Copper Wire.—1898.
- DRAPER, C. W.
Computing Machine with Indicating and Registering Mechanism.—1904.
- EBERHARDT, HENRY F., AND ULRICH, F. L.
Radial Gang Cutter.—1904.
- EDDISON, WILLIAM BARTON.
Jet Entraining Apparatus.—1921.
- EDISON, THOMAS A., AND BROWN, HAROLD P.
Rail Bonds and Electrical Contacts.—1899.
- EDWARDS, LEVI TALBOT.
Compound Air-Lift System.—1918.
- ELLIS, CARLETON.
Paint and Varnish Remover.—1916.
- EVE, A. S.
"Modern Views on the Construction of the Atom" (Paper).—1916.
- FAY, C. N., SHOLES, Z. G., AND HOCHKLASSEN, H.
Typewriting Machine.—1901.
- FOLLETT, W. L.
Time Stamp.—1906.
- FORMER AND SCHWING MFG. COMPANY.
Graflex Cameras.—1905.
- FORRES, J. S., AND ADAMS, W. G.
Stop Valve for Radiators.—1893.
- FREAS, SAMUEL T.
"Interlocking" Tooth Saw.—1922.
- FRICK, FRED
Electric Program Clock.—1890.
- FULLER, G. W.
"Biochemical and Engineering Aspects of Sanitary Water Supply"
(Paper).—1916.
- GOLDMAN, HENRY.
Arithmachine.—1901.
- GOODYEAR, CHARLES
Projection Lantern.—1895.
- GOANBURY, J. H.
Stadia Rod.—1900.

HARTNESS, JAMES.

Screw Thread Comparator.—1922.

HEILPRIN, A.

Improved Ventilating Car Window.—1897.

HENNING, G. C.

Pocket Recorder for Tests of Materials.—1899.

HEPBURN, J. S.

"Chemistry of Sugar" (Paper).—1911.

HERR, H. T.

"Development of Steam Turbines" (Paper).—1914.

HICKS, THOMAS WILLING.

"Once-Over" Tiller.—1922.

HILL, F. B.

Improvement in the Treatment of Sewage.—1893.

HIRSCH, H. H.

Electric Safety Lamp.—1914.

HITE, B. H.

Sterilization by High Pressure.—1920.

HOADLEY, H. G.; WILLIAMS, H. D.; LEWIS, E. C.

Lever and Ratch Attachment.—1900.

HOCHKLASSEN, H.; FAY, C. N., AND SHOLES, Z. G.

Typewriting Machine.—1901.

HOLLINGSHEAD, W. B.

Automatic Disinfectant Ejector.—1898.

HOLMAN, A. J. AND COMPANY.

Self-Pronouncing Bibles.—1900.

HOOVEN, OWENS, RENTSCHLER CO.

Hooven Automatic Typewriter.—1917.

HUMPHREYS, W. J.

"Volcanic Dust, Climatic Changes and Ice Ages" (Paper).—1914.

HYDE, E. P.

"Physical Production of Light" (Paper).—1911.

INTERNATIONAL LIGHT, HEAT AND POWER COMPANY.

Incandescent Lamp.—1901.

INTERNATIONAL MONEY MACHINE COMPANY.

Money Machine.—1917.

IVES, H. E.; KINGSBURY, E. F.; KARRER, E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

IVES, H. E.

"Artificial Daylight" (Paper).—1915.

IVES, H. E.

Improvements in Diffraction Color Photographs and Mode of Making Same.—1907.

IVES, F. E.

Photo-Micrographic Process.—1903.

IVINS, E.

Product of Tube Making.—1894.

JOHNSTON, A. L.

Automatic Safe Electric Disconnecter.—1894.

JONES, H. C.

"Nature of Solution" (Paper).—1913.

JONES, J. R.

Machine for Rolling Car Wheels.—1892.

KARNS, J. P., COMPANY.

Tunneling Machine.—1909.

KARRER, E.; KINGSBURY, E. F.; IVES, H. E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

KELLER, JOSEPH, F.

Automatic Die Cutting Machine.—1922.

KEMP, W. W., AND VAN HORN, W. H.

Gas System.—1919.

KENNELLEY, A. E.; ACHARD, F. H.; DANA, A. S.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—1917.

KINGSBURY, E. F.; KARRER, E.; IVES, H. E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

KINKEAD MANUFACTURING COMPANY.

Apparatus for Aligning and Levelling Shafting.—1914.

KITSON, A.

System of Oil Heating and Incandescent Lighting.—1901.

KNAPP, I. N.

"Natural Gas" (Paper).—1913.

KOTHNY, G. L., AND SUCZEK, ROBERT.

Radojet Air Pump.—1920.

KROLL, G.

Convertible Carriage.—1896.

LAIRD SCHOBOR AND COMPANY.

General Excellence in Manufacturing Shoes.—1900.

LATHROP, E., AND SCHREINER, O.

"Organic Constituents in Soil" (Paper).—1912.

LEDoux, J. W.

Fluid Meter.—1919.

LEEDS, MORRIS E.

Recording Devices.—1920.

LENKER, WILL G.

L-E-Vation Rod.—1915.

LEVY, MAX.

Counting Chamber for Haemocytometer.—1917.

- LEWIS, E. C.; WILLIAMS, H. D.; HOADLEY, H. G.
Lever and Ratch Attachment.—1900.
- LEWIS, JOHN F., AND MATTES, WM. F.
Locomotive Cylinder Lubricator.—1894.
- LEWIS, W.
Inertia Indicator.—1899.
- LLOYD, M. G.
"Magnetic Hysteresis" (Paper).—1911.
- LODGE, GEORGE.
Electro-Magnetic Street Railway System.—1896.
- LUCKIESH, M.
"The Visibility of Airplanes" (Paper).—1920.
- LUPTON, D., SON AND COMPANY.
Automatic Closing Fireproof Metal Window.—1904.
- MACKAY, WILLIAM M.
Operating Valve.—1893.
- MCALLISTER, E. J., AND DESCHLER, CHARLES.
Portable Photometer.—1900.
- MARSH, E. B.,
Metallic Corner Bead.—1897.
- MATTES, WILLIAM F., AND LEWIS, J. F.
Locomotive Cylinder Lubricator.—1894.
- MEEKER, G. H.
New Apparatus and Method in Clinical Chemistry.—1906.
- MENLO PARK CERAMIC WORKS.
Decorative Tile and Faience Work.—1890.
- MILEY, HENRY M., AND MICHAEL.
Color Photography.—1905.
- MILLER, DAYTON C.
"A 32-Element Harmonic Synthesizer" (Paper).—1917.
- MOORE, RICHARD B.
"Biography of Sir William Ramsay" (Paper).—1919.
- MORSELL, W. F. C.
Sectional Models for Stereometric Representation.—1903.
- NOISELESS TYPEWRITER COMPANY.
Typewriter.—1922.
- NORTHROP, E. F.
"Vortex Motion in Liquids" (Paper).—1912.
- PANTASOTE LEATHER COMPANY.
"Pantasote."—1896.
- PFUND, A. H.
Colorimeter, Cryptometer, Paint Film Gauge and Rotating Sector.—
1922.

PHILADELPHIA CREMATION SOCIETY.

System of Cremation.—1892.

PITKIN, A. J.

Compound Locomotive.—1891.

PITTLER, J. W., VON

Turret Lathe.—1903.

PRESTWICH, JOHN ALFRED.

Fluid Gauge.—1918.

RANKIN, GEORGE A.

"Portland Cement" (Paper).—1917.

RECKLINGHAUSEN, M. VON.

"Ultra-Violet Rays" (Paper).—1915.

REESE, B. D.

Dirigible Balloon.—1910.

REEVES, MILTON O.

Variable Speed Countershaft.—1900.

REGAN, H. C., JR.

Closed Conduit Electric Railway.—1897.

RICHARDS, G. M.

Automatic Fluid Pressure Friction Clutch.—1897.

RIKER, C. L.

Lavatory.—1900.

RINGLAND, ALBERT, AND SCHOENFUSS, F. H.

Portable Brinell Meter.—1917.

ROBY, HENRY, W.

Screw Jack.—1891.

ROEDER, J. R.

Improvement in Windows.—1892.

ROPER, CHARLES.

Safety Propellers.—1900.

ROSENDALE BELTING COMPANY.

Camel Hair Belting.—1893.

ROUSSEL, W. J.

Cipher Code System.—1902.

RUSBY, J. M.

"Industrial Combustible Gases" (Paper).—1914.

RUSHTON, K.

Improvements in Trailing Trucks for Locomotives.—1910.

RUUD, EDWIN.

Instantaneous Automatic Water Heater.—1904.

SCHEMERHORN, W. GEORGE.

Folding Boat.—1891.

SCHLINK, FREDERICK J.

Stabilized Platform Weighing Scale.—1910.

- SCHMIDT, MAX, AND SIEBER, JOSEPH.
Movable Sidewalk.—1894.
- SCHMIDT, HENRY J., AND BONNELL, RUSSELL.
Gate Valves.—1901.
- SCHOENFUSS, FRANK H., AND RINGLAND, ALBERT.
Portable Brinell Meter.—1917.
- SCHREINER, O., AND LATHROP, E.
"Organic Constituents in Soils" (Paper).—1912.
- SCRIPTURE, E. W.
Color Sense Tester.—1903.
- SEITZ, HENRY JEROME.
Coal Loading and Screening Machines.—1904.
- SHARPLES, SPECIALTY COMPANY.
Super-Centrifuge.—1916.
- SHAW, H. M.
Lightning Arrester.—1904.
- SHELLENBACH, WILLIAM L.
Variable Speed Countershaft.—1903.
- SHOLES, Z. K.; FAY, C. N.; HOCHKLASSEN, H.
Typewriting Machine.—1901.
- SIEBER, JOSEPH, AND SCHMIDT, MAX E.
Movable Sidewalk.—1894.
- SKINNER, JOSHUA J.
"Soil Aldehydes" (Paper).—1919.
- SNOOK, HOMER CLYDE.
X-Ray System.—1919.
- SOCIÉTÉ GENEVOISE.
Measuring Machine.—1923.
- SPITZGLASS, JACOB M.
Republic Flow Meter.—1921.
- STAR BRASS MANUFACTURING COMPANY.
Steam Gauge.—1894.
- STEARNS MANUFACTURING COMPANY.
Automatic High Speed Engine.—1892.
- STONE, JOHN STONE.
"Propagation of Electric Waves Along Wires" (Paper).—1913.
- STRADLING, GEORGE F.
"Modern Theories of Magnetism" (Paper).—1916.
- STUMPF, J.
Una Flow Steam Engine.—1909.
- SUCZEK, ROBERT, AND KOTHNY, G. L.
Radojet Air Pump.—1920.
- TAINTOR, C. C.
Positive Saw-Set.—1895.

- TAUSSIG, JOHN H., AND ZEEK, CHARLES F.
Automatic Operation of Water Gas Sets.—1918.
- TEAL, B. F.
Anti-friction Universal Joint for Shafting.—1909.
- THOMAS, C. C.
"Measurement of Gases" (Paper).—1912.
- TIERNAN, MARTIN F., AND WALLACE, C. F.
Chlorinator.—1922.
- TOERRING, C. J.
Electric Arc Lamp.—1903.
- TOWNSEND, T. F.
Improved Thermometer Support.—1907.
- TUCKER, W. H.
Letter and Document Files.—1900.
- TURNER, W. V.
"Locomotive Air-Brake" (Paper).—1911.
- TUTWILER, C. C.
"Recovery of Gas Works by-Products" (Paper).—1915.
- ULRICH, FREDERICK L., AND EBERHARDT, H. E.
Radial-Duplex Gang Cutters.—1904.
- UNDERWOOD, JOHN, AND COMPANY.
Combined Calculating and Typewriting Machine.—1915.
- VAN ALLER, TYCHO.
Calorizing Process.—1918.
- VAN HORN, WILLIAM H., AND KEMP, WILLIAM W.
Kemp Gas System.—1919.
- WAGGNER, B. G.
Prepayment Gas Meter.—1916.
- WACNER ELECTRIC MANUFACTURING COMPANY.
Single Phase Alternating Current Power Motor.—1902.
- WAHL ADDING MACHINE COMPANY.
Adding Machine.—1916.
- WALLACE, C. F., AND TIERNAN, MARTIN F.
Chlorinator.—1922.
- WATERBURY TOOL COMPANY.
Double Universal Joint.—1904.
- WEIDLOG, CHARLES B.
Indicator for Boring Machines.—1906.
- WELSPACH LIGHT COMPANY.
Various Manufactured Products.—1901.
- WENTWORTH, C. C.
Improvements in Hydraulic Rams.—1903.

- WETHERILL, HENRY EMERSON.
New Physical Diagnostic Instruments.—1906.
- WHEELER, GEORGE A.
Step Type Escalator.—1914.
- WHITE, J. J.
Journal Box.—1891.
- WHITEHEAD, J. B.
"The Electric Strength of Air and Methods of Measuring High Voltage" (Paper).—1918.
- WILLIAMS, BROWN AND EARLE.
Kerosene Lamp for Magic Lanterns.—1902.
- WILLIAMS, H. D.; HOADLEY, H. G.; LEWIS, E. C.
Lever and Ratch Attachment.—1900.
- WILLIAMSON, E. D., AND ADAMS, L. H.
"The Annealing of Glass" (Paper).—1921.
- YAWMAN & ERBE MANUFACTURING COMPANY.
Rapid Roller Copier.—1904.
- YOUNG, C. D.
"Locomotive Superheaters" (Paper).—1915.
- ZEEK, CHARLES F., AND TAUSSIG, JOHN H.
Automatic Operation of Water Gas Set.—1918.

CERTIFICATE OF MERIT AWARDS

1885-1923

- BAYLIS, R. N.
Brush Holder and Brusher for Dynamos.—1900.
- BEIN, EMIL J.
Letter and Document Files.—1900.
- BINGHAM, EUGENE C.
Viscometer.—1922.
- BLANTON, E. A., JR.
Shaft Coupling, Nut Locks, Cams, etc.—1910.
- BLONCK, W. A.
Boiler Efficiency Meter.—1914.
- BLOUNT, EUGENE I., AND TAYLOR, WARREN H.
Door Check.—1902.
- BRANCH, C. J.
Electric Light Shade.—1900.
- BULLARD, REAR ADMIRAL W. H. G.
"The Application of Radio to Navigation Problems" (Paper).—1922.
- BYERLY, F. E.
Cutter and Cutter Head.—1893.

CANDEE, C. H.

Car Truck and Journal Bearings.—1887.

COOK, J. S.

Self-Lubricating Journal Box.—1898.

DEMPSTER, J. T. H.; FLEMING, RICHARD; GENERAL ELECTRIC COMPANY; STEIN-METZ, C. P.

Magnetic Lamp.—1908.

DERYCKE, J.

Steam Separator.—1894.

DODGE, W. W.

Wooden Split Pulley.—1885.

DUNN, G. S.

Automatic Electric Brake Motor.—1902.

ELLSWORTH, F. G.

The Knudson and Ellsworth Telephone.—1891.

ELTONHEAD, W. B.

Nut Lock.—1885.

ETCHELLS, HARRY, AND GREAVES, H. A.

Electric Arc Furnace.—1922.

FLEMING, RICHARD; DEMPSTER, J. T. H.; GENERAL ELECTRIC COMPANY; STEIN-METZ, C. P.

Magnetic Lamp.—1908.

GENERAL ELECTRIC COMPANY; DEMPSTER, J. T. H.; FLEMING, RICHARD; STEIN-METZ, C. P.

Magnetic Lamp.—1908.

GETTY, JOHN K.

Bicycle Support.—1896.

GILSON, EMERY G.

Calorizing Process.—1918.

GLAZIER, JOHN T. AND PETER F.

Universal Nozzle.—1904.

GOWDEY, J.

Compartment Drawer.—1902.

GREAVES, H. A., AND ETCHELLS, HARRY.

Electric Arc Furnace.—1922.

GREENE, F. V. AND M. A.

Improvement in Windows.—1892.

HAINES, R. B., JR

Automatic Micrometer Gauge for Hot Metal.—1896.

HALLANAN, M.

Horseshoe and Pad.—1896.

HALLBERG, J. H.

Current System for Trunk Line Railways.—1906.

HANSON, FREEMAN.

Wood Turning Machine.—1891.

HARBOLSHEIMER, J.

Garbage Box.—1894.

HAVARD, OLIVER D.

Coal Meter.—1918.

HAYS, CHARLES AND JOSEPH.

CO₂ and Draft Recorder.—1920.

HEPBURN, J. S.; ST. JOHN, E. Q.; JONES, F. M.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

HILL, EDGAR.

Caliper Measuring Device.—1903.

HILL, MYRON F.

Roller Bearings.—1902.

INTERNATIONAL BURGLAR IMMUNITY CO.

Electric Protective Devices.—1905.

JONES, FRANK MORTON; HEPBURN, J. S.; ST. JOHN, E. Q.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

KIIDE, WALTER, AND COMPANY.

Improved System of Detecting and Extinguishing Marine Fires.—1922

KINNEY, R. D.

Internal Fired Water Tube Boiler.—1899.

LANCE, W. L.

Utilizing Oil Cloth Waste.—1888.

LAND, S.

Sash Cord Fastener.—1886.

LANDAU, DAVID, AND PARR, PERCY H

"A New Theory of Plate Springs" (Paper).—1920.

MCCHESNEY, R.

Improvements in T-Squares.—1893.

MACDONALD, THOMAS H.

Apparatus for Recording Sound.—1900.

MCINTYRE COMPANY.

Electric Wire.—1893.

McLAUTHLIN, MARTIN B., AND TAYLOR, GEORGE.

Household Garbage Carbonizer.—1895.

MAXON, HARRY R.

Pre-mix Burner.—1923.

MENDENHALL, CHARLES E.

"Aeronautic Instruments" (Paper).—1922.

NABER, H. A.

Gas Voltameter.—1895.

NATIONAL NUTRIENT COMPANY.

Nutrium, a new food Product.—1902.

NEUMEYER, H. F.

Spray Nozzle.—1895.

NOUY, P. LECOMTE DU.

Surface Tension Apparatus.—1923.

PARR, PERCY H., AND LANDAU, DAVID.

"A New Theory of Plate Springs" (Paper).—1920.

PARVIN, A. B.

Tele-photo Lens.—1895.

PHELPS, W. J.

Hylo-Incandescent Lamp.—1903.

PICH, FRIEDRICH.

Cast Iron Brazing.—1903.

PITNEY, ARTHUR H.

Postage Meter.—1922.

REAGAN, JAMES.

Improved Gates.—1900.

RIDGWAY, E. B.

Steam Hydraulic Elevator.—1914.

RINN, J. J.

Tent Fastening.—1904.

ROBINSON, CYRUS R.

Improved Fire Nozzle.—1905.

ROLIN, CHARLES W.

Adjustable and Interchangeable Grate.—1918.

ROWLAND, L. G.

Automatic Safety Device for Electric Circuits.—1897.

SADTLER, J. P. B.

Water Heater for Range Boilers.—1900.

SCHENCK, W. T. Y.

Improved Hose Reels.—1893.

SHEAF, PHILIP A.

Circle Drawing Attachment for Microscopes.—1916.

SIMPSON, W. L.

Steam Separator.—1894.

STEIN, F. J.

An Improved and Simplified System of Pitman Phonography.—1904.

STEINMETZ, C. P.; DEMPSTER, J. T. H.; FLEMING, RICHARD; GENERAL ELECTRIC COMPANY.

Magnetic Lamp.—1908.

ST. JOHN, E. Q.; HEPBURN, J. S.; JONES, F. M.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

SWEETLAND, ERNEST J.

Metallic Filter Cloth.—1918.

SWETT AND LEWIS COMPANY.

Static Machine for X-Ray Apparatus.—1899.

TAYLOR, GEORGE, AND McLAUTHLIN, MARTIN B.

Household Garbage Carbonizer.—1895.

TAYLOR, WARREN H., AND BLOUNT, EUGENE I.

Door Check.—1902.

TUCKFIELD, C. B.

Stove Pipe Anchor.—1896.

VANIER, G. P.

Potash Bulb.—1914.

WARDEN, J. T.

Improved Drawing Board.—1893.

WEBER, GEORGE AND WILLIAM.

Speaking Attachment for Telephone.—1894.

WHINERY, SAMUEL BRENT.

Improved Method of Blueprinting.—1902.

WHITE, E. M.

Chimney for Incandescent Lamp.—1898.

WICKERSHAM, W.

Printers' Quoin.—1894.

WILKES, M.

Automatic Cut-Off for Slide Valve Engines.—1889.

JOHN SCOTT MEDAL AWARDS

1835-1918.

ABT, R.

System of Mountain Railways.—1889.

ACHESON, E. G.

"Carborundum."—1894.

ACHESON, E. G.

Artificial Graphite.—1901.

- DESHLER, CHARLES, AND McALLISTER, EDWARD J.
Portable Photometer.—1900.
- DeVOE, W. R.
Conduit Electric Railway.—1894.
- DODGE, WALLACE H.
Wooden Split Pulley.—1891.
- DOOLITTLE, T. B.
Hard Drawn Copper Wire.—1898.
- DRAPER, C. W.
Computing Machine with Indicating and Registering Mechanism.—1904.
- EBERHARDT, HENRY F., AND ULRICH, F. L.
Radial Gang Cutter.—1904.
- EDDISON, WILLIAM BARTON.
Jet Entraining Apparatus.—1921.
- EDISON, THOMAS A., AND BROWN, HAROLD P.
Rail Bonds and Electrical Contacts.—1899.
- EDWARDS, LEVI TALBOT.
Compound Air-Lift System.—1918.
- ELLIS, CARLETON.
Paint and Varnish Remover.—1916.
- EVE, A. S.
"Modern Views on the Construction of the Atom" (Paper).—1916.
- FAY, C. N., SHOLES, Z. G., AND HOCHKLASSEN, H.
Typewriting Machine.—1901.
- FOLLETT, W. I.
Time Stamp.—1906.
- FOLMER AND SCHWING MFG. COMPANY.
Graflex Cameras.—1905.
- FORBES, J. S., AND ADAMS, W. G.
Stop Valve for Radiators.—1893.
- FREAS, SAMUEL T.
"Interlocking" Tooth Saw.—1922.
- FRICK, FRED
Electric Program Clock.—1899.
- FULLER, G. W.
"Biochemical and Engineering Aspects of Sanitary Water Supply"
(Paper).—1916.
- GOLDMAN, HENRY.
Arithmachine.—1901.
- GOODYEAR, CHARLES.
Projection Lantern.—1895.
- GRANBERY, J. H.
Stadia Rod.—1909.

HARTNESS, JAMES.

Screw Thread Comparator.—1922.

HEILPRIN, A.

Improved Ventilating Car Window.—1897.

HENNING, G. C.

Pocket Recorder for Tests of Materials.—1879.

HEPBURN, J. S.

"Chemistry of Sugar" (Paper).—1911.

HERR, H. T.

"Development of Steam Turbines" (Paper).—1914.

HICKS, THOMAS WILLING.

"Once-Over" Tiller.—1922.

HILL, F. B.

Improvement in the Treatment of Sewage.—1893.

HIRSCH, H. H.

Electric Safety Lamp.—1914.

HITE, B. H.

Sterilization by High Pressure.—1920.

HOADLEY, H. G.; WILLIAMS, H. D.; LEWIS, E. C.

Lever and Ratch Attachment.—1900.

HOCHKLASSEN, H.; FAY, C. N., AND SHOLES, Z. G.

Typewriting Machine.—1901.

HOLLINGSHEAD, W. B.

Automatic Disinfectant Ejector.—1898.

HOLMAN, A. J. AND COMPANY.

Self-Pronouncing Bibles.—1900.

HOOVEN, OWENS, RENTSCHLER CO.

Hooven Automatic Typewriter.—1917.

HUMPHREYS, W. J.

"Volcanic Dust, Climatic Changes and Ice Ages" (Paper).—1914.

HYDE, E. P.

"Physical Production of Light" (Paper).—1911.

INTERNATIONAL LIGHT, HEAT AND POWER COMPANY.

Incandescent Lamp.—1901.

INTERNATIONAL MONEY MACHINE COMPANY.

Money Machine.—1917.

IVES, H. E.; KINGSBURY, E. F.; KARRER, E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

IVES, H. E.

"Artificial Daylight" (Paper).—1915.

IVES, H. E.

Improvements in Diffraction Color Photographs and Mode of Making Same.—1907.

IVES, F. E.

Photo-Micrographic Process.—1903.

IVINS, E.

Product of Tube Making.—1894.

JOHNSTON, A. L.

Automatic Safe Electric Disconnecter.—1894.

JONES, H. C.

"Nature of Solution" (Paper).—1913.

JONES, J. R.

Machine for Rolling Car Wheels.—1892.

KARNS, J. P., COMPANY.

Tunneling Machine.—1909.

KARRER, E.; KINGSBURY, E. F.; IVES, H. E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

KELLER, JOSEPH, F.

Automatic Die Cutting Machine.—1922.

KEMP, W. W., AND VAN HORN, W. H.

Gas System.—1919.

KENNELLEY, A. E.; ACHARD, F. H.; DANA, A. S.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—1917.

KINGSBURY, E. F.; KARRER, E.; IVES, H. E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

KINKEAD MANUFACTURING COMPANY.

Apparatus for Aligning and Levelling Shafting.—1914.

KITSON, A.

System of Oil Heating and Incandescent Lighting.—1901.

KNAPP, I. N.

"Natural Gas" (Paper).—1913.

KOTHNY, G. L., AND SUCZEK, ROBERT.

Radojet Air Pump.—1920.

KROLL, G.

Convertible Carriage.—1896.

LAIRD, SCHOBBER AND COMPANY.

General Excellence in Manufacturing Shoes.—1900.

LATHROP, E., AND SCHREINER, O.

"Organic Constituents in Soil" (Paper).—1912.

LEDoux, J. W.

Fluid Meter.—1919.

LEEDS, MORRIS E.

Recording Devices.—1920.

LENKER, WILL G.

L-E-Vation Rod.—1915.

LEVY, MAX.

Counting Chamber for Haemocytometer.—1917.

- LEWIS, E. C.; WILLIAMS, H. D.; HOADLEY, H. G.
Lever and Ratch Attachment.—1900.
- LEWIS, JOHN F., AND MATTES, WM. F.
Locomotive Cylinder Lubricator.—1894.
- LEWIS, W.
Inertia Indicator.—1899.
- LLOYD, M. G.
"Magnetic Hysteresis" (Paper).—1911.
- LODGE, GEORGE.
Electro-Magnetic Street Railway System.—1896.
- LUCKIESH, M.
"The Visibility of Airplanes" (Paper).—1920.
- LUPTON, D., SON AND COMPANY.
Automatic Closing Fireproof Metal Window.—1904.
- MACKAY, WILLIAM M.
Operating Valve.—1893.
- MCALLISTER, E. J., AND DESCHLER, CHARLES.
Portable Photometer.—1900.
- MARSH, E. B.,
Metallic Corner Bead.—1897.
- MATTES, WILLIAM F., AND LEWIS, J. F.
Locomotive Cylinder Lubricator.—1894.
- MEEKER, G. H.
New Apparatus and Method in Clinical Chemistry.—1906.
- MENLO PARK CERAMIC WORKS.
Decorative Tile and Faience Work.—1890.
- MILEY, HENRY M., AND MICHAEL.
Color Photography.—1905.
- MILLER, DAYTON C.
"A 32-Element Harmonic Synthesizer" (Paper).—1917.
- MOORE, RICHARD B.
"Biography of Sir William Ramsay" (Paper).—1919.
- MORSELL, W. F. C.
Sectional Models for Stereometric Representation.—1903.
- NOISELESS TYPEWRITER COMPANY.
Typewriter.—1922.
- NORTHROP, E. F.
"Vortex Motion in Liquids" (Paper).—1912.
- PANTASOTE LEATHER COMPANY.
"Pantasote."—1896.
- PFUND, A. H.
Colorimeter, Cryptometer, Paint Film Gauge and Rotating Sector.—
1922.

PHILADELPHIA CREMATION SOCIETY.

System of Cremation.—1892.

PITKIN, A. J.

Compound Locomotive.—1891.

PITTLER, J. W., VON

Turret Lathe.—1903.

PRESTWICH, JOHN ALFRED.

Fluid Gauge.—1918.

RANKIN, GEORGE A.

"Portland Cement" (Paper).—1917.

RECKLINGHAUSEN, M. VON.

"Ultra-Violet Rays" (Paper).—1915.

REESE, B. D.

Dirigible Balloon.—1910.

REEVES, MILTON O.

Variable Speed Countershaft.—1900.

REGAN, H. C., JR.

Closed Conduit Electric Railway.—1897.

RICHARDS, G. M.

Automatic Fluid Pressure Friction Clutch.—1897.

RIKER, C. L.

Lavatory.—1900.

RINGLAND, ALBERT, AND SCHOENFUSS, F. H.

Portable Brinell Meter.—1917.

ROBY, HENRY, W.

Screw Jack.—1891.

ROEDER, J. R.

Improvement in Windows.—1892.

ROPER, CHARLES.

Safety Propellers.—1900.

ROSENDALE BELTING COMPANY.

Camel Hair Belting.—1893.

ROUSSEL, W. J.

Cipher Code System.—1902.

RUSBY, J. M.

"Industrial Combustible Gases" (Paper).—1914.

RUSHTON, K.

Improvements in Trailing Trucks for Locomotives.—1910.

RUUD, EDWIN.

Instantaneous Automatic Water Heater.—1904.

SCHEMERHORN, W. GEORGE.

Folding Boat.—1891.

SCHLINK, FREDERICK J.

Stabilized Platform Weighing Scale.—1910.

- SCHMIDT, MAX, AND SIEBER, JOSEPH.
Movable Sidewalk.—1894.
- SCHMIDT, HENRY J., AND BONNELL, RUSSELL.
Gate Valves.—1901.
- SCHOENFUSS, FRANK H., AND RINGLAND, ALBERT.
Portable Brinell Meter.—1917.
- SCHREINER, O., AND LATHROP, E.
"Organic Constituents in Soils" (Paper).—1912.
- SCRIPTURE, E. W.
Color Sense Tester.—1903.
- SEITZ, HENRY JEROME.
Coal Loading and Screening Machines.—1904.
- SHARPLES, SPECIALTY COMPANY.
Super-Centrifuge.—1916.
- SHAW, H. M.
Lightning Arrester.—1904.
- SHELLENBACH, WILLIAM L.
Variable Speed Countershaft.—1903.
- SHOLES, Z. K.; FAY, C. N.; HOCHKLASSEN, H.
Typewriting Machine.—1901.
- SIEBER, JOSEPH, AND SCHMIDT, MAX E.
Movable Sidewalk.—1894.
- SKINNER, JOSHUA J.
"Soil Aldehydes" (Paper).—1919.
- SNOOK, HOMER CLYDE.
X-Ray System.—1919.
- SOCIÉTÉ GENEVOISE.
Measuring Machine.—1923.
- SPITZGLASS, JACOB M.
Republic Flow Meter.—1921.
- STAR BRASS MANUFACTURING COMPANY.
Steam Gauge.—1894.
- STEARNS MANUFACTURING COMPANY.
Automatic High Speed Engine.—1892.
- STONE, JOHN STONE.
"Propagation of Electric Waves Along Wires" (Paper).—1913.
- STRADLING, GEORGE F.
"Modern Theories of Magnetism" (Paper).—1916.
- STUMPF, J.
Una Flow Steam Engine.—1909.
- SUCZEK, ROBERT, AND KOTHNY, G. L.
Radojet Air Pump.—1920.
- TAINTOR, C. C.
Positive Saw-Set.—1895.

- TAUSSIG, JOHN H., AND ZEEK, CHARLES F.
Automatic Operation of Water Gas Sets.—1918.
- TEAL, B. F.
Anti-friction Universal Joint for Shafting.—1909.
- THOMAS, C. C.
"Measurement of Gases" (Paper).—1912.
- TIERNAN, MARTIN F., AND WALLACE, C. F.
Chlorinator.—1922.
- TOERRING, C. J.
Electric Arc Lamp.—1903.
- TOWNSEND, T. F.
Improved Thermometer Support.—1907.
- TUCKER, W. H.
Letter and Document Files.—1900.
- TURNER, W. V.
"Locomotive Air-Brake" (Paper).—1911.
- TUTWILER, C. C.
"Recovery of Gas Works by-Products" (Paper).—1915.
- ULRICH, FREDERICK L., AND EBERHARDT, H. E.
Radial-Duplex Gang Cutters.—1904.
- UNDERWOOD, JOHN, AND COMPANY.
Combined Calculating and Typewriting Machine.—1915.
- VAN ALLER, TYCHO.
Calorizing Process.—1918.
- VAN HORN, WILLIAM H., AND KEMP, WILLIAM W.
Kemp Gas System.—1919.
- WAGGNER, B. G.
Prepayment Gas Meter.—1916.
- WACNER ELECTRIC MANUFACTURING COMPANY.
Single Phase Alternating Current Power Motor.—1902.
- WAHL ADDING MACHINE COMPANY.
Adding Machine.—1916.
- WALLACE, C. F., AND TIERNAN, MARTIN F.
Chlorinator.—1922.
- WATERBURY TOOL COMPANY.
Double Universal Joint.—1904.
- WEIDLOG, CHARLES B.
Indicator for Boring Machines.—1906.
- WELSPACH LIGHT COMPANY.
Various Manufactured Products.—1901.
- WENTWORTH, C. C.
Improvements in Hydraulic Rams.—1903.

WETHERILL, HENRY EMERSON.

New Physical Diagnostic Instruments.—1906.

WHEELER, GEORGE A.

Step Type Escalator.—1914.

WHITE, J. J.

Journal Box.—1891.

WHITEHEAD, J. B.

"The Electric Strength of Air and Methods of Measuring High Voltage" (Paper).—1918.

WILLIAMS, BROWN AND EARLE.

Kerosene Lamp for Magic Lanterns.—1902.

WILLIAMS, H. D.; HOADLEY, H. G.; LEWIS, E. C.

Lever and Ratch Attachment.—1900.

WILLIAMSON, E. D., AND ADAMS, L. H.

"The Annealing of Glass" (Paper).—1921.

YAWMAN & ERBE MANUFACTURING COMPANY.

Rapid Roller Copier.—1904.

YOUNG, C. D.

"Locomotive Superheaters" (Paper).—1915.

ZEEK, CHARLES F., AND TAUSSIG, JOHN H.

Automatic Operation of Water Gas Set.—1918.

CERTIFICATE OF MERIT AWARDS

1885-1923

BAYLIS, R. N.

Brush Holder and Brusher for Dynamos.—1909.

BEIN, EMIL J.

Letter and Document Files.—1900.

BINGHAM, EUGENE C.

Viscometer.—1922.

BLANTON, E. A., JR.

Shaft Coupling, Nut Locks, Cams, etc.—1910.

BLONCK, W. A.

Boiler Efficiency Meter.—1914.

BLOUNT, EUGENE I., AND TAYLOR, WARREN H.

Door Check.—1902.

BRANCH, C. J.

Electric Light Shade.—1909.

BULLARD, REAR ADMIRAL W. H. G.

"The Application of Radio to Navigation Problems" (Paper).—1922.

BYERLY, F. E.

Cutter and Cutter Head.—1893.

CANDEE, C. H.

Car Truck and Journal Bearings.—1887.

COOK, J. S.

Self-Lubricating Journal Box.—1898.

DEMPSTER, J. T. H.; FLEMING, RICHARD; GENERAL ELECTRIC COMPANY; STEIN-METZ, C. P.

Magnetic Lamp.—1908.

DERYCKE, J.

Steam Separator.—1894.

DODGE, W. W.

Wooden Split Pulley.—1885.

DUNN, G. S.

Automatic Electric Brake Motor.—1902.

ELLSWORTH, F. G.

The Knudson and Ellsworth Telephone.—1891.

ELTONHEAD, W. B.

Nut Lock.—1885.

ETCHELLS, HARRY, AND GREAVES, H. A.

Electric Arc Furnace.—1922.

FLEMING, RICHARD; DEMPSTER, J. T. H.; GENERAL ELECTRIC COMPANY; STEIN-METZ, C. P.

Magnetic Lamp.—1908.

GENERAL ELECTRIC COMPANY; DEMPSTER, J. T. H.; FLEMING, RICHARD; STEIN-METZ, C. P.

Magnetic Lamp.—1908.

GETTY, JOHN K.

Bicycle Support.—1896.

GILSON, EMERY G.

Calorizing Process.—1918.

GLAZIER, JOHN T. AND PETER F.

Universal Nozzle.—1904.

GOWDEY, J.

Compartment Drawer.—1902.

GREAVES, H. A., AND ETCHELLS, HARRY.

Electric Arc Furnace.—1922.

GREENE, F. V. AND M. A.

Improvement in Windows.—1892.

HAINES, R. B., JR

Automatic Micrometer Gauge for Hot Metal.—1896.

HALLANAN, M.

Horseshoe and Pad.—1896.

HALLBERG, J. H.

Current System for Trunk Line Railways.—1906.

HANSON, FREEMAN.

Wood Turning Machine.—1891.

HARBOLSHEIMER, J.

Garbage Box.—1894.

HAVARD, OLIVER D.

Coal Meter.—1918.

HAYS, CHARLES AND JOSEPH.

CO₂ and Draft Recorder.—1920.

HEPBURN, J. S.; ST. JOHN, E. Q.; JONES, F. M.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

HILL, EDGAR.

Caliper Measuring Device.—1903.

HILL, MYRON F.

Roller Bearings.—1902.

INTERNATIONAL BURGLAR IMMUNITY CO.

Electric Protective Devices.—1905.

JONES, FRANK MORTON; HEPBURN, J. S.; ST. JOHN, E. Q.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

KINDE, WALTER, AND COMPANY.

Improved System of Detecting and Extinguishing Marine Fires.—1922

KINNEY, R. D.

Internal Fired Water Tube Boiler.—1899.

LANCE, W. L.

Utilizing Oil Cloth Waste.—1888.

LAND, S.

Sash Cord Fastener.—1886.

LANDAU, DAVID, AND PARR, PERCY H

"A New Theory of Plate Springs" (Paper).—1920.

MCCHESNEY, R.

Improvements in T-Squares.—1893.

MACDONALD, THOMAS H.

Apparatus for Recording Sound.—1900.

MCINTYRE COMPANY.

Electric Wire.—1893.

McLAUTHLIN, MARTIN B., AND TAYLOR, GEORGE.

Household Garbage Carbonizer.—1895.

MAXON, HARRY R.

Pre-mix Burner.—1923.

MENDENHALL, CHARLES E.

"Aeronautic Instruments" (Paper).—1922.

NABER, H. A.

Gas Voltameter.—1895.

NATIONAL NUTRIENT COMPANY.

Nutrium, a new food Product.—1902.

NEUMEYER, H. F.

Spray Nozzle.—1895.

NOUY, P. LECOMTE DU.

Surface Tension Apparatus.—1923.

PARR, PERCY H., AND LANDAU, DAVID.

"A New Theory of Plate Springs" (Paper).—1920.

PARVIN, A. B.

Tele-photo Lens.—1895.

PHELPS, W. J.

Hylo-Incandescent Lamp.—1903.

PICH, FRIEDRICH.

Cast Iron Brazing.—1903.

PITNEY, ARTHUR H.

Postage Meter.—1922.

REAGAN, JAMES.

Improved Gates.—1900.

RIDGWAY, E. B.

Steam Hydraulic Elevator.—1914.

RINN, J. J.

Tent Fastening.—1904.

ROBINSON, CYRUS R.

Improved Fire Nozzle.—1905.

ROLIN, CHARLES W.

Adjustable and Interchangeable Grate.—1918.

ROWLAND, L. G.

Automatic Safety Device for Electric Circuits.—1897.

SADTLER, J. P. B.

Water Heater for Range Boilers.—1900.

SCHENCK, W. T. Y.

Improved Hose Reels.—1893.

SHEAF, PHILIP A.

Circle Drawing Attachment for Microscopes.—1916.

SIMPSON, W. L.

Steam Separator.—1894.

STEIN, F. J.

An Improved and Simplified System of Pitman Phonography.—1904.

STEINMETZ, C. P.; DEMPSTER, J. T. H.; FLEMING, RICHARD; GENERAL ELECTRIC COMPANY.

Magnetic Lamp.—1908.

ST. JOHN, E. Q.; HEPBURN, J. S.; JONES, F. M.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

SWEETLAND, ERNEST J.

Metallic Filter Cloth.—1918.

SWETT AND LEWIS COMPANY.

Static Machine for X-Ray Apparatus.—1899.

TAYLOR, GEORGE, AND McLAUTHLIN, MARTIN B.

Household Garbage Carbonizer.—1895.

TAYLOR, WARREN H., AND BLOUNT, EUGENE I.

Door Check.—1902.

TUCKFIELD, C. B.

Stove Pipe Anchor.—1896.

VANIER, G. P.

Potash Bulb.—1914.

WARDEN, J. T.

Improved Drawing Board.—1893.

WEBER, GEORGE AND WILLIAM.

Speaking Attachment for Telephone.—1894.

WHINERY, SAMUEL BRENT.

Improved Method of Blueprinting.—1902.

WHITE, E. M.

Chimney for Incandescent Lamp.—1898.

WICKERSHAM, W.

Printers' Quoin.—1894.

WILKES, M.

Automatic Cut-Off for Slide Valve Engines.—1889.

JOHN SCOTT MEDAL AWARDS

1835-1918.

ABT, R.

System of Mountain Railways.—1889.

ACHESON, E. G.

"Carborundum."—1894.

ACHESON, E. G.

Artificial Graphite.—1901.

- ADT, J. B.
Tobacco Machine.—1901.
- AKELEY, CARL E.
Cement-Gun.—1916.
- ALBERT, C. F.
Musical Instruments.—1901.
- ALGER, H. C.
Liquid Measurer.—1912.
- ALMOND, T. R.
Angular Coupling.—1892.
- ALMOND, T. R.
Flexible Tube.—1897.
- AMERICAN PRISMATIC LIGHT COMPANY.
Light Projecting Glass.—1901.
- ANDERSON, H. N.
Gear Rolling Machine.—1915.
- ANDERSON, LEVI.
File Cutting.—1842.
- ANDERSON, WILLIAM.
Apparatus for Water Purification.—1891.
- ASHFORD, HENRY.
Boat Attaching and Detaching Apparatus.—1883.
- ATKINS, J.
Self-Raking Automatic Reaper and Mover.—1854.
- ATKINSON, J.
Gas Engine.—1889.
- BABBITT, I.
Axle Boxes for Railway Cars.—1840.
- BABBITT, I.
Soft Metal Boxes.—1842.
- BAEKLAND, LEO H.
Bakelite.—1909.
- BAKER, J. G.
Pressure Blower.—1875.
- BALDWIN, F. S.
Calculating Machine.—1874.
- BALDWIN, F. R.
Boiler Tube Cleaner.—1893.
- BALLENTINE, W. I.
Apparatus for Testing Hardness and Density of Metal, etc.—1908.
- BALZER, S. M.
Device for Backing off and Forming Milling Cutters.—1896.
- BARDWELL, JOHN.
Votometer.—1901.

- BASSETT, H.
Compasses.—1835.
- BATCHELLOR, B. C.
Pneumatic Dispatch Tube Apparatus.—1899.
- BATDORF, C. S.
Coin Counting and Wrapping Machine.—1914.
- BATES, ALBERT J.
Improved Corliss Engine.—1895.
- BATES, ROBERT.
Instrument for the Cure of Stammering.—1854.
- BEADLE, C.; BEVAN, E. J.; CROSS, C. F.
Cellulose Products.—1895.
- BEAN, E. W.
Device for Ascertaining Latitude.—1837.
- BEECHER, JAMES.
Hollow Handled Cutlery.—1883.
- BEHREND, B. A.
High Speed Electric Generators.—1909.
- BEHRNS, G. L. H., AND BREMAR, A.
Aspirator for Mill Stones.—1877.
- BELL, CHICHESTER A., AND TAINTER, SUMMER.
Apparatus for Recording Sound.—1900.
- BENNOR, JOSEPH.
Siphon Trap.—1884.
- BENNOR, JOSEPH.
Knitting Machine.—1892.
- BERKEFELD, W.
Germ Proof Water Filter.—1893.
- BERLINER, E.
Gramophone.—1897.
- BEVAN, E. J.; BEADLE, C.; CROSS, C. F.
Cellulose Products.—1895.
- BILGRAM, HUGO.
Bevel Gear Cutter.—1887.
- BILGRAM, HUGO.
Gearing for Metal Planners.—1882.
- BILYEU, THOMAS.
International Money Machine.—1917.
- BLAKEY, THOMAS W., AND COURTENAY, WILLIAM.
Reconstructed Granite.—1900.
- BLICKENSERFER, GEORGE C.
Typewriting Machine.—1901.
- BLODGETT BROTHERS.
Electrical Signal Clock.—1883.
- BLONDEL, ANDRE, AND PAAROWDAKI, SPIRIDION.
Holophane Globes.—1898.

BRADLEY, ANDREW.

Stencil Machine.—1902.

BRAMWELL, W. C.

Feeding Machine for Fibrous Material.—1894.

BRANSON, D.; THORNBURGH, R. D.; STARR, J. E.; FULLER, J. E.

Refrigeration Process.—1894.

BREHMER, HUGO, AND HEYL, HENRY RAND.

Wire Book Sewing Machine.—1883.

BREMAR, A., AND BEHRNS, G. L. H.

Aspirator for Mill Stones.—1877.

BRIDGMAN, H. L.

Automatic Ore Sampler.—1893.

BRILL, J. A.

Convertible Cars, Traction Trucks.—1904.

BRITTIN, J. W., AND TATHAM, B.

Safety Catch for Elevators.—1875.

BROWN, EDWARD.

Pyrometers.—1897.

BROWNING, JOHN M.

Automatic Pistol.—1906.

BURGER, H. J.

Photo-Polychrome Printing Apparatus.—1903.

BURRELL, JOHN H., AND METZLER, C. E.

Railway Signal Lantern.—1885.

BURROUGHS, W. S.

Calculating Machine.—1897.

BURROWS, AMOS E.

Feed-Water Regulator.—1904.

BURT, W. A.

Variation Compass.—1835.

BURTON, G. D.

Electric Forging Device.—1892.

BURTON, W. L.

Electric Heater.—1890.

CALAHAN, E. A.

Synchronous Multiplex Telegraphy.—1886.

CALDERHEAD, A.

Looms.—1840.

CAMPBELL, P. T. AND C. H.

Apparatus for Reconstructing Milk.—1904.

CARLETON, CYRUS, AND WILCOX, CHARLES H.

Automatic Tension and Improved Sewing Machines.—1875.

CARNELL, CHARLES.

Brick Machine.—1850.

- CARNEY, THOS.; COOK, H.; AND PATTERSON, H. G. AND J. H.
Cash Registers.—1901.
- CARROLL, W. T.
Non-Metalic Bearings.—1896.
- CASTNER, H. Y.
Apparatus for the Manufacture of Sodium and Potassium.—1889.
- CERASOLI, ALBERTO, AND HUMPHREY, H. A.
Hydraulic Pump.—1914.
- CHABOT, CYPRIEN.
Shoe Sole Channelling Machine.—1885.
- CHABOT, CYPRIEN.
Shoe Sewing Machine.—1885.
- CHABOT, CYPRIEN.
Shoe Sole Edge Turning Machine.—1885.
- CHABOT, CYPRIEN.
Beveled Rim Watch Cases.—1886.
- CHAMBERS, C.
Brick Machine. 1875.
- CHAMBERS, C.
Book Folding and Pasting Machine.—1874.
- CHAUVENET, WILLIAM.
Great Circle Protractor.—1857.
- CHENOWETH, A. C.
Electric Conduits.—1890.
- CHENOWETH, A. C.
Steel Concrete Foundation Piles.—1906.
- CLARK, G. S.
Device for Safety Vaults.—1892.
- CLAUD, G. M.; HESS, G. A.; FOCHE, EDMUND.
Process of Storing Explosive Gases.—1903.
- CLEBORNE, C. J.
Bedstead.—1894.
- COLBY, E. A.
Electric Furnace for Melting Metals.—1909.
- COLTON, SABIN W.
Improved Locks.—1848.
- CONNET, FREDERICK N., AND JACKSON, W. W.
Improved Venturi Meter.—1898.
- COOK, H.; CARNEY, T.; PATTERSON, H. G. AND J. H.
Cash Registers.—1901.
- COOPER, DANIEL.
Time Recorder.—1898.
- COURTENAY, WILLIAM, AND BLAKEY, THOMAS W.
Reconstructed Granite.—1900.
- COWLES, EUGENE H., AND ALFRED H.
Electric Smelting Furnace.—1887.

COWPER-COWLES, SHERARD.

Method of Depositing Metals on Metallic Surfaces.—1911.

CREHORE, A., AND SQUIRE, G. O.

Polarizing Photo-Chronograph.—1896.

CROSS, C. F.; BEADLE, CLAYTON; BEVAN, E. J.

Cellulose Products.—1895.

CROSS, W. A.

Horizontal Folding Door.—1903.

CYCLOSTYLE COMPANY.

Cyclostyle.—1888.

DALE, JOHN D.

Wood Molding Machine.—1857.

DARLING, J. D.

Apparatus for Producing Metals and Nitric Acid from Fused Nitrates.—1901.

DAVIS, JOB A.

Vertical Feed for Sewing Machine.—1875.

DENISON, L. C.

Corn Sheller.—1839.

DIETZ, GUSTAV.

High Speed Photographic Between-lens Shutter.—1909.

DILKS, J.

Water Gauges.—1853.

DOBBINS, E. J.

Daylight Rod.—1914.

DOBBINS, EDWARD J., AND MOFFETT, GEORGE.

Light Projecting Glass.—1901.

DOBLE, W. A.

Tangential Water Wheel.—1904.

DOCK, H.

Rivet Thread Tool.—1901.

DODGE, J. M.

Storage Structure for Coal and Analogous Material.—1904.

DODGE, WALLACE H.

System of Rope Transmission.—1891.

DOERR, JOHN H., AND WIGMORE, WILLIAM H.

Sleeping Car.—1885.

DORR, JOHN V. H.

Hydrometallurgical Apparatus.—1916.

DOWNES, L. W.

Fireproof Insulated Wire.—1905.

DRESSLER, CONRAD D'HUC.

Tunnel Kiln.—1918.

DUNCAN, JOSEPH S.

Addressograph.—1903.

- DUNHAM, JOSEPH M., AND McKEMMIL, JOHN.
Metallic Drawing Tools.—1894.
- DUNN, B. W.
Testing Machine for Measuring Intensities of Impulsive Forces.—1898.
- DURKEE, G. B., AND GOLDING, JOHN F.
Expanded Metal.—1897.
- DUTTON, R. & Co.
Mowing Machine.—1877.
- ECKSTEIN, H. G.
Feed Water Heater.—1884.
- EDISON, T. A.
Mimeograph.—1889.
- EDSON, J. B.
Pressure Recording Gauge.—1894.
- EHBETS, C. J.
Improved Revolver.—1890.
- ELDRED, BYRON E.
Process for Flame Regulation.—1906.
- ELDRIDGE, G. M.
Electro Magnetic Protector for Electric Instruments.—1884.
- ELLIS, H.
Combined Calculating and Writing Machine.—1909.
- ELMER AND LITTLE.
Chronometer.—1837.
- EMERSON, J.
Power Scale.—1892.
- EWBANK, T.
Lead Pipes.—1835.
- FABER, GEORGE.
Magnetic Water Gage.—1853.
- FAHY, FRANK P.
Permeameter.—1918.
- FAWKES, JOSEPH W.
Steam Plow.—1859.
- FELLOWS, E. R.
Machine and Cutter for Generating Gear Teeth.—1899.
- FELT, D. E.
Comptometer.—1890.
- FIELD, D. W., AND SPENCER, JOHN E.
Damper Regulator.—1893.
- FISHER, ROBERT T.
Improved Book and Letter Typewriter.—1899.
- FORTEN, R. B.
Telescope.—1840.

- FOUCHE, E.; CLAUDE, G. M. A.; HESS, G. M.
Process for Storing Explosive Gases.—1902.
- FRAHM, HERMANN.
Speed Indicator, Frequency Teller and Revolution Counter.—1907.
- FRANCIS, JEROME B.
Tooth Extractor.—1860.
- FRAZER, PERSIFOR.
Apparatus for Quantitative Colorimetry.—1905.
- FULLER, FRED L., AND GRISWALD, GEORGE H.
Cash Register and Indicator.—1892.
- FULLER, J. E.; BRANSON, D.; THORNBURGH, R. D.; STARR, J. E.
Refrigeration Process.—1894.
- FURBISH, ZACHARY T.
Ratchet Tools.—1904.
- GARROD, R. P.
Annunciators.—1891.
- GATES, JOHN.
Lubricator.—1888.
- GIBBONS, C. L.
Street Railway Construction.—1892.
- GILLESPIE, ALFRED J.
Voting Machine.—1902.
- GLIDDENS, CARLOS; SHOLES, C. L.; SOULE, S. W.
Improved Typewriter.—1875.
- GODDARD, K.
Carriage Axle.—1852.
- GOETZ, G. M.
Device for Anchoring Beams.—1891.
- GOLDBERG, H. E., AND WAHL, J. C.
Adding Machine.—1916.
- GOLDING, J. F.; AND DURKEE, G. B.
Expanded Metal.—1897.
- GOLDSTEIN, A.
Pneumatic Fire Alarm Telegraph System.—1895.
- GOODES, E. A.
Sewing Machine.—1875.
- GOODWIN, WILLIAM FARR.
Mowing Machine.—1879.
- GOODYEAR, ROBERT B.
Harness Motion for Power Looms.—1875.
- GOODYEAR, ROBERT B.
Shuttle Box Operating Mechanism.—1875.
- GRANT, GEORGE B.
Calculating Machine.—1877.

- GRANT, GEORGE B.
Calculating Machine.—1896.
- GRAU, PHILIP J.
Feed Water Purifier and Heater.—1886.
- GREENE, E. V.
Apparatus for Extracting Oil and Albuminoid from Corn.—1851.
- GRIMES, W. C.
Water Gauge for Steam Boilers.—1851.
- GRIMES, W. C.
Smut Machine.—1840.
- GRISWALD, GEORGE H., AND FULLER, FRED L.
Cash Register and Indicator.—1892.
- GROUPE, A. V.
Braiding Machine.—1900.
- GUILLAUME, C. E.
Invar Alloy.—1914.
- HADFIELD, ROBERT A.
Manganese Steel.—1891.
- HAHL, A. L.
Pneumatic Clock.—1901.
- HAINES, ROBERT B., JR.
Automatic Micrometer Rolling Mill Plate Gauge.—1901.
- HAKEWESSEL, REINHOLD, AND HENN, EDWIN C.
Automatic Screw and Metal Working Machine.—1901.
- HALL, THOMAS.
Typewriter.—1884.
- HALL, M. W.
Duplex Steam Pump.—1886.
- HALLOCK, DAVID.
Weighing Scale.—1887.
- HALLOWELL, HOWARD T.
Pressed Steel Shaft Hangers.—1906.
- HAMMER, WILLIAM J.
Apparatus for Long Distance Phonographic and Telephonic Experiments.—1902.
- HANNAY, J. B., AND SHEDLOCK, ALFRED.
Lucigen.—1891.
- HANSON, HANS, AND HART, FREDERICK A.
Calculating and Typewriting Machine.—1915.
- HARDINGE, H. W.
Conical Pebble Mill.—1915.
- HARO, A LOPEX DE.
Electric Sea Compass; Automatic Electric Log Line.—1890.
- HART, EDWARD.
Acid Container.—1891.

- HART, FREDERICK A., AND HANSON, HANS.
Combined Calculating and Typewriting Machine.—1915.
- HART, WALTER.
Hoisting Machine.—1891.
- HEANY, J. A.
Enclosed Arc Lamp.—1904.
- HECTROTTE, A. G.
Car Coupling.—1848.
- HELLINGS, J.
Mail Bag Fastener.—1890.
- HENN, E. C., AND HAKEWESSEL, REINHOLD.
Automatic Screw and Metal Working Machine.—1901.
- HERAEUS, W. C.
Fused Quartz Mercury Lamp.—1906.
- HERAEUS, W. E.
Improvements on the LeChatelier Pyrometer.—1907.
- HERMAN, HENRY O.
Star Ventilator.—1902.
- HERR, H. A.
Liquid Extraction Apparatus.—1909.
- HESS, G. A., CLAUDE, G. M. A., FOCHE, E.
Process of Storing Explosive Gases.—1902.
- HEXAMER, C. J.
Apparatus for Preventing and Extinguishing Fires in Grinding Mills.—1888.
- HEYL, HENRY R., AND BREHMER, HUGO.
Wire Book Sewing Machine.—1883.
- HEYL, HENRY R.
Wire Fastened Paper Boxes.—1875.
- HIGGINS, A., AND JACOBS, C. B.
Alundum Refractories.—1909.
- HILL, T.
Calculating Instrument.—1843.
- HOBSON, A. E.
Hydraulic Shaping Press.—1890.
- HOLCOMB, A.
Reflecting Telescope.—1835.
- HOPKINS, EDWARD P.
Electric Arc Lamp.—1896.
- HOPKINS, N. M.
Pneumatic Water Pipe Cushioning.—1900.
- HOUGH, JAMES, AND LAUGHLIN, SAMUEL.
Drawing Tables.—1900.
- HUMPHREY, F. A.
Improved Sawing Machine and Guide.—1901.

HUMPHREY, H. A., AND CERASOLI, ALBERTO.

Hydraulic Pump.—1914.

HUTCHINS AND MABBITT.

Tilting Chair.—1875.

HYATT, I. S.

Purification of Water System.—1888.

HYATT, J. W.

Roller Bearings.—1898.

IHLDER, J. D.; SMITH, A. C.; SUNDH, AUGUST; OTIS, SIDNEY.

Electric Elevator.—1902.

IRWIN, JOHN H.

Lantern.—1873.

IVES, FREDERICK E.

Isochromatic Photography.—1887.

IVES, FREDERICK E.

Projecting Lantern and Appurtenances.—1890.

IVES, FREDERICK E.

Parallax Stereogram.—1904.

IVES, FREDERICK E.

New Form of Replica of Rowland Diffraction Grating.—1905.

IVES, FREDERICK E.

Color Meter.—1907.

JACKSON, WALTER W., AND CONNET, F. N.

Improved Venturi Meter.—1898.

JACOBS, C. B., AND HIGGINS, A. C.

Alundum Refractories.—1909.

JANDUS, WILLIAM.

Enclosed Arc Lamp.—1895.

JAY, PERRIE EGMOND.

Automatic Anti-Freezing Valve.—1885.

JENKINS, C. F.

Motion Pictures Apparatus.—1909.

JENKS, W.

Fire Arms.—1840.

JEWELL, M. R.; POWERS, T. B.; KELLY, J. F.

Teleelectric Piano Player.—1910.

JOHNSON, A. L.

Bonding Joint for Electric Railways.—1896.

JOHNSON, E. H.

Interior Electric House Conduit.—1891.

JONES, ALFRED C.

Shaft Couplings.—1842.

JONES, EVAN W.

Underfeed Mechanical Stoker.—1904.

JONES, H. P.

Baling Machine.—1901.

JONES, J. R.

Method of and Apparatus for Axle Rolling.—1892.

KELLY, J. F.; POWERS, T. B.; JEWELL, M. R.

Teleelectric Piano Player.—1910.

KEMBLE, B. H.

Wheel Hubs.—1883.

KENT, A. ATWATER.

Ignition System for Automobiles.—1914.

KITE, J. S.

Safety Beam.—1840.

KNEASS, S. L.

Injector.—1901.

KOYL, C. H.

Parabolic Semaphore.—1889.

KURTZ, DAVID T.

Cap Screws and Bolts.—1905.

LA RUE, S. H.

Stove for Soft or Bituminous Coal.—1893.

LATTIG, J. W.

Automatic Electric Semaphore Signal.—1904.

LAUGHLIN, SAMUEL, AND HOUGH, JAMES.

Drawing Tables.—1900.

LECLERE, FRANCIS.

Black Printing Process.—1897.

LECLERE, FRANCIS.

Toothed Gear Wheel.—1891.

LEONARD, H. W.

System of Motor Control.—1902.

LEVY, M. AND L. E.

Screens for Photo-Mechanical Engraving.—1897.

LEWIS, WILFRED; TABOR, HARRIS; MUMFORD, E.

Molding Machine.—1902.

LINCOLN, P. M.

Synchronism Indicator.—1902.

LITTLE AND ELMER.

Chronometer.—1837.

LOSS, HENRIK V.

Solid Steel Railway Wheels Manufactured by Hydraulic Forging with Rolling.—1904.

LOVEKIN, L. D.

Device for Relieving Forces due to Inertia and Weight of Valve Gears.—1910.

- LOWE, J.
Spinning Mule.—1890.
- LUNGREN, CHARLES M.
Incandescent Gas Light.—1892.
- MACCOY, J. S.
Pneumatic Tool.—1890.
- MCCALL, THOMAS A., AND PILLINGS, JOHN H.
Automatic Typewriter.—1917.
- MCCAULEY, THOMAS, AND REED, C. J.
Speed-Jack.—1907.
- MCCLELLAN, EZRA S.
Anti-Siphon Vent.—1892.
- MCCRACKEN, EDWIN D.
Insulated Electrical Conductors.—1896.
- MCINTIRE, C.
Electric Wire Connectors.—1890.
- McKEE, M. A.
Process of Treating Printing Plates.—1912.
- McKEMMIL, JOHN, AND DUNHAM, JOSEPH M.
Metallic Drawing Rolls.—1894.
- McMAHAN, J.
Stereotyping Plate.—1835.
- McMULLEN, JOHN.
Machine for Knitting Stockings.—1835.
- MACHLET, GEORGE, AND REICHELME, E. P.
Apparatus for Producing Fuel Gas.—1894.
- MCCURDY, ARTHUR W.
Apparatus for Developing Photographic Roll Prints.—1904.
- MADDOX, R. L.
Substitution of Gelatine for Collodion in Photography.—1889.
- MAHAN, FRANCIS.
Measure Case Ruler.—1837.
- MARCY, L. J.
Magic Lantern.—1887.
- MARKS, A. A.
Artificial Limbs.—1889.
- MARSDEN, M.
Corn-pith Cellulose.—1896.
- MASON, A. J.
Washer Punching Machine.—1891.
- MELLOR, L. B.
Device for Measuring and Recording the Variable Diameter of Tubes.—
1903.
- MERGENTHALER, O.
Linotype.—1889.

- MERKET, LUZERNE, AND THOMAS, ALMER.
Tempered Copper.—1891.
- MERRICK AND TOWNE.
Boring Machine.—1840.
- MERSHON, R. D.
Compensated Potential Indicator.—1901.
- METZLER, CHRISTIAN E., AND BURRELL, JOHN H.
Railway Signal Lantern.—1885.
- MEYERS, J. G.
Mausoleum.—1889.
- MEYLAN, EUGENE, AND RECKNIEWSKI, CAMILLE S.
Electric Meter.—1893.
- MILLER, D. K.
Self Locking Padlock.—1883.
- MILLIAU, EDWARD.
Apparatus for Analyzing Fats and Oils.—1896.
- MOFFET, GEORGE, AND DOBBINS, EDWARD J.
Light Projecting Glass.—1901.
- MOORE, D. McFARLAN.
Vacuum-tube Light.—1909.
- MOORE, LEE C.
Wire Testing Machine.—1904.
- MORRIS, HENRY G., AND SALOM, PEDRO G.
Electric Automobile.—1897.
- MORSE, EVERETT F.
Heat Gage.—1903.
- MORSE, EVERETT F.
Drive Chains.—1901.
- MORSELL, W. F. C.
Complementary Color Designs and Crystal Patterns.—1894.
- MOSER, L.
"Bohemian" Glassware.—1886.
- MOSKOWITZ, MORRIS.
System of Car Lighting.—1900.
- MUELLER, H. C.
Apparatus and Process for Manufacturing Mosaics.—1898.
- MUMFORD, EDGAR; LEWIS, WILFRED; TABOR, H.
Molding Machine.—1902.
- NACKE, ARNOLD.
Screw Cutting Attachment.—1883.
- NAGLE, H. M.
Flat Bar or Edge Rail for Railroad Curves.—1842.
- NERNST LAMP COMPANY.
Incandescent Lamp.—1906.

- NICHOLS, H. B., AND VOYNOW, C. B.
Cast Zinc Joint for Rail-Bonding.—1906.
- OLDS, CALVIN.
Planting Machine.—1840.
- ORUM, MORRIS L.
Improved Lock.—1885.
- ORUM, MORRIS L.
Mandrel for Bending Metal Pipes.—1875.
- OTIS, SIDNEY; SMITH, R. C.; IHLDER, J. D.; SUNDH, AUGUST.
Electric Elevator.—1902.
- OUTERBRIDGE, A. E., JR.
Method of Carbonizing Fabrics and Castings Therefrom.—1888.
- OUTERBRIDGE, A. E., JR.
Method for Investigating the Molecular Physics of Cast Iron.—1897.
- PAAROWDAKI, SPIRIDION, AND BLONDEL, ANDRE.
Holophane Globes.—1898.
- PALMER, B. F.
Artificial Leg.—1849.
- PALMER, FREDERICK; REYNOLDS, J. R.; TIRRELL, J. P.
Engine Stop and Speed Limit System.—1906.
- PARKER, ZEBULON.
Water Wheel.—1847.
- PARKINSON, EDWARD.
Knitting Machine.—1905.
- PARSONS, L. H.
Scale Measure.—1852.
- PATTERSON, H. G.; PATTERSON, J. G.; CARNEY, T.; COOK, H.
Cash Registers.—1901.
- PATTERSON, J. G.; PATTERSON, H. G.; CARNEY, T.; COOK, H.
Cash Registers.—1901.
- PAYEN, C.
Chloride Electrical Storage Battery.—1894.
- PEALE, F.
Coining Presses at the United States Mint, Philadelphia.—1840.
- PENTZ, A. D.
Boring and Milling Engine.—1891.
- PERRY, N. W.
Method of Series Electric Traction.—1894.
- PFATISCHER, MATTHIAS.
Variable Speed Motors.—1909.
- PHELPS, L. J.
Induction Telegraph.—1886.
- PHOENIX IRON COMPANY.
Automatic Cut-Off Steam Engine.—1886.

- PILLINGS, JOHN H., AND MCCALL, THOMAS A.
Automatic Typewriter.—1917.
- PONTRICHET, J.
"Heliographic" Paper.—1894.
- POOLE AND COMPANY, J. MORTON.
Grinding Metallic Calendar Rolls.—1875.
- POWERS, T. B.; JEWELL, M. R.; KELLY, J. F.
Teleelectric Piano Player.—1910.
- PRATT AND WHITNEY COMPANY.
Taps and Gauges.—1883.
- PRATT AND WHITNEY COMPANY.
System of Interchangeable Cut Gears.—1886.
- PRENTISS, H. S.
Automatic Calendar.—1896.
- PRIESTMAN, W. D. AND SAMUEL.
Steam Engine.—1894.
- PRUNTY, JOHN E.
Relief Valve.—1875.
- PRUTZMAN, A.
Door Lock.—1836.
- REAGAN, J.
Grate Bars.—1908.
- RECEVEUR, P. N.
Rose Engine (Lathe).—1853.
- RECKNIEWSKI, CAMILLE, AND MEYLAN, EUGENE.
Electric Meter.—1893.
- REDDAWAY, FRANK.
Camel Hair Belting.—1898.
- REED, CHARLES J., AND McCAULEY, THOMAS.
Speed-Jack.—1906.
- REICHHELM, E. P., AND MACHLET, GEORGE.
Apparatus for Producing Fuel Gases.—1894.
- RENO, J. W.
Escalator.—1910.
- REYNOLDS, J. R.; PALMER, FREDERICK S.; TIRRELL, J. P.
Engine Stop and Speed Limit System.—1906.
- RHOADS, J.
Map for the Blind.—1840.
- RICHARDS, J.
Solder for Aluminum.—1896.
- RICHARDS, J.
Balance for Testing White Metal Alloys.—1901.
- RICHARDS, T. A.
Ruling Machine.—1890.

RICHARDSON.

Eccentric Door Spring.—1840.

RICHARDSON, J. H.

Signal Lantern.—1868.

RIDGWAY, T. S., JR.

Transit Theodolite.—1839.

RIDGWAY, W. H.

Balanced Crane.—1890.

RIEFLER, SIGMUND.

Mercurial Compensation Pendulum.—1894.

RITCHIE, E. S.

Improved Rhumkorff Coil.—1860.

RITES, F. M.

Perfecting of Shaft Governor System.—1902.

ROEDER, F. A., AND SPRINGER, ALFRED.

Torsion Balance.—1891.

RONDINELLA, L. F.

Photo-Printing Machine.—1905.

ROOT, J. B.

Spiral Weld Tubing.—1890.

ROOTS, P. H. AND F. M.

Rotary Pressure Blower.—1875.

RORER, T. J.

Belting.—1875.

ROSENBAUM, WALTER A.

Automatic Hydraulic Letter Copying Press.—1905.

SACHS, J.

Enclosed Fuse Protective Devices.—1903.

SALOM, PEDRO G., AND MORRIS, HENRY G.

Electric Automobile.—1897.

SARGENT, C. E.

Expansion Gas Engine.—1907.

SAYEN, H. L.

Improved Roentgen Ray Tubes.—1898.

SAXTON, J.

Reflecting Pyrometer.—1842.

SHELLENBACH, WILLIAM S.

System of Gearing.—1902.

SCHMIDT, M. E.

Moving Platform.—1906.

SCHOOP, MAX ULRICH.

Metal Spraying Process.—1917.

SEE, H.

Hydro-Pneumatic Ash Ejector.—1904.

- SEMPLE, J. B.
Shell Torch or Tracer.—1905.
- SENNEFF, JACOB.
Eye-Harness for Metallic Heddle.—1853.
- SEVERY, M. L.
Printing Machine.—1898.
- SEYMOUR, C.
Balancer for Pulleys, Fly Wheels, etc.—1878.
- SEXTON, A.
Slide Rule.—1899.
- SHAW, T.
Instrument for Testing Ignitable Gases in Mines.—1889.
- SHAW, THOMAS.
Gunpowder Pile Driver.—1872.
- SHAW, THOMAS.
Spiral Exhaust Nozzle.—1877.
- SHAW, THOMAS.
Friction Buffer.—1883.
- SHAY, EPHRAIM.
Geared Locomotive.—1892.
- SHEDLOCK, ALFRED, AND HANNAY, J. B.
Lamp for Engineering Uses.—1891.
- SHIMER, P. W.
Combustion Crucible.—1901.
- SHOLES, C. LATHAM; GLIDDENS, CARLOS; SOULE, SAMUEL W.
Typewriter.—1875.
- SHORE, A. F.
Scleroscope.—1909.
- SHUMAN, F. S.
Wired Glass.—1894.
- SHUMAN, F.
Concrete Pile for Foundations.—1904.
- SMITH, R. C.; OTIS, SIDNEY; IHLDER, J. D.; SUNDH, AUGUST.
Electric Elevator.—1902.
- SOULE, SAMUEL W.; GLIDDENS, CARLOS; SHOLES, C. LATHAM.
Typewriter.—1875.
- SPEIDEL, J. G.
Hoisting Machines.—1891.
- SPELLIER, L. H.
Electric Clock.—1887.
- SPENCER, J. E., AND FIELD, D. W.
Damper Regulator.—1893.
- SPERRY, E. A.
Gyroscope Compass.—1914.
- SPIELMAN, A.
Cloth Cutting Machine.—1914.

- SPIRO, C.
Barlock Typewriter.—1894.
- SPRATT, ORLANDS, W.
Mercury Seal Trap.—1885.
- SPRINGER, ALFRED, AND ROEDER, F. A.
Torsion Balance.—1891.
- SQUIER, G. O., AND CREHORE, A.
Polarizing Photo-Chronograph.—1896.
- STACKHOUSE, THOMAS H.
Diagraph.—1895.
- STAHLBERG, C.
Time Dating Stamp.—1891.
- STARR, J. E.; BRANSON, DAVID; THORNBURGH, R. D.; FULLER, J. E.
Refrigeration Process.—1894.
- STEINBART, ALFRED, AND UEHLING, EDWARD.
Pneumatic Pyrometer.—1898.
- STEINBART, ALFRED, AND UEHLING, EDWARD.
Gas Composimeter.—1899.
- STELLWAGON, H. S.
Sounding Apparatus.—1848.
- STIERINGER, L.
Improved Method of Electric Illumination.—1902.
- STREET, CLEMENT F.
Locomotive Stoker.—1915.
- STRICKLAND, W.
Substitution of Lime for Salt for Preserving Lumber.—1840.
- SUNDH, AUGUST; OTIS, SIDNEY; SMITH, A. C.; IHLDER, J. D.
Electric Elevator.—1902.
- SWEETLAND, ERNEST J.
Filter Press.—1918.
- SWENSON, MAGNUS.
Round Lap Baling Cotton Compress.—1900.
- TABER, HARRIS; LEWIS, WILFRED; MUMFORD, E.
Molding Machines.—1902.
- TAINTER, SUMMER, AND BELL, CHICHESTER A.
Apparatus for Recording Sound.—1900.
- TALBOT, E.
Improved Methods in the Manufacture of Steel.—1908.
- TATHAM, B., AND BRITTIN, J. W.
Safety Catch for Elevators.—1875.
- TATTERSALL, ALFRED R.
Flour Mill.—1917.
- TAYLOR, C. M., JR.
Absorption Process for Butter Making.—1903.

- TEAL, C. A.
Portable Hoist.—1889.
- THOMAS, ALMER, AND MERKET, LUZERNE.
Tempered Copper.—1891.
- THOMSON, ELIHU.
Electric Welding.—1889.
- THOMSON, ELIHU.
Constant Current Arc Light Transformer.—1901.
- THORNBURGH, R. D.; STARR, J. E.; BRANSON, DAVID; FULLER, J. E.
Refrigeration Process.—1894.
- THUM, CHARLES D.
Varnish Brushes.—1854.
- TIRRILL, A. A.
Voltage Regulator.—1910.
- TIRRELL, J. P.; REYNOLDS, J. R.; PALMER, F. S.
Engine Stop and Speed Limit System.—1906.
- TOWNSEND, ISAAC.
Tent Fastening.—1885.
- TWEDDELL, R. H.
Method of Applying Hydraulic Power to Mechanical Work.—1894.
- TYLER, PHILOS B.
Shifting Gauge Cock for Steam Boilers.—1835.
- TYSON, CHARLES.
Machine to Unite Uppers to the Soles of Shoes.—1875
- UEHLING, EDWARD, AND STEINBART, ALFRED.
Gas Composimeter.—1899.
- UEHLING, EDWARD, AND STEINBART, ALFRED.
Pneumatic Pyrometer.—1898.
- VAN KANNEL, T.
Storm Door.—1890.
- VAUCLAIN, SAMUEL M.
Truck Wheel Centres.—1891.
- VILLEROI, M.
Telescope.—1849.
- VOYNOW, C. B., AND NICHOLS, H. B.
Cast Zinc Joint for Rail Bonding.—1904.
- WAHL, J. C., AND GOLDBERG, H. E.
Adding Machine.—1916.
- WAIT, W. B.
Machine for Tangible Writing for Touch Reading.—1900.
- WALE, GEORGE AND COMPANY.
Projection Lantern.—1875.

- WALSH, E. M. AND SYDNEY B.
Method of Making Large Objects from Pieces of Aventurine.—1902.
- WALSH, SYDNEY B. AND E. M.
Method of Making Large Objects from Pieces of Aventurine.—1902.
- WALTER, L. H.
Method of Detecting Electrical Oscillations.—1907.
- WALTER, B.
Electric Switch.—1905.
- WEBSTER, W. R.
Apparatus for Observing the Relations between the Chemical Constitution and Ultimate Strength of Steel.—1897.
- WEHNELT, A.
Interrupter for Induction Machines.—1905.
- WELIN, A.
Life Saving Appliances on Board Ship.—1910.
- WESTINGHOUSE, GEORGE, JR.
Railway Car Brake.—1874.
- WETZEL, F. J.
Automatic Mechanical Stoker.—1909.
- WHARTON, WILLIAM, JR.
Safety Railway Switch.—1873.
- WHEELER, S. S.
Electric Fan.—1904.
- WHITALL, HENRY.
Planisphere.—1883.
- WHITE, O. C.
Adjustable Extension Movement in Ball and Socket Joints.—1889.
- WIEDIG, H. P.
Chemical Fire Extinguisher.—1894.
- WIGMORE, WILLIAM H., AND DOERR, JOHN H.
Sleeping Car.—1885.
- WILKIN, J. T.
System of Generating and Forming Cycloidal Surfaces.—1894.
- WILCOX, CHARLES H., AND CARLETON, CYRUS.
Automatic Tension and Improved Sewing Machines.—1875.
- WILLANS, P. W.
Steam Engine.—1895.
- WILLIAMS, C. D.
Revolving Show Window.—1892.
- WILLIAMS, JOHN N.
Typewriting Machine.—1897.
- WILLMUNDER, H.
Swivel Loom.—1898.
- WILLS, SAMUEL.
Journal Bearing and Car Axle-Box.—1885.

WINSLOW, S. E.

Pivot Scale Beam.—1840.

WIRT, CHARLES.

Rheostat.—1902.

WOOD, R. W.

Diffraction Color Photography.—1907.

WOOD, THOMAS.

Fountain Pen.—1839.

WOODBURY, C. J. H.

Electric Light Main Testing Apparatus.—1884.

WOODRUFF, W. N.

System of Keying for Machinery.—1888.

WOOTEN, J. E.

Locomotive and Boiler.—1890.

WURTZ, A. J.

Lightning Arrestors and Non-Arcing Metal.—1894.

YARYAN, H. T.

System of Evaporation in Vacuo.—1886.

YEOMANS, LUCIEN I.

Method of Machine Construction.—1917.

ZIEGLER, G. W.

Trestles and Scaffolding.—1888.

MEETINGS AND LECTURES

1922-1923

Thursday, October 5, 1922—"The Primary Standard of Light."

By HERBERT E. IVES, PH.D.

Research Laboratories of the American Telephone and Telegraph Company and Western Electric Company, Incorporated, New York City.

This lecture will first review the present situation with respect to standards of light. The characteristics of the flame standards now used will be critically discussed, and the deficiencies of the various standards proposed to replace them will be set forth.

Following this will be a description of the experimental realization by the lecturer of the standard proposed some years ago by Waidner and Burgess, namely, the brightness of the black body at the melting point of platinum. The theoretical studies and experimental methods involved will be described in detail, and the merits and significance of the new primary standard established by this research discussed at length.

The lecture will be illustrated by exhibits and lantern slides.

Joint meeting with Philadelphia Section, Illuminating Engineering Society.

Wednesday, October 18, 1922—"The Study of Earth Movements in California."

By ARTHUR L. DAY, PH.D.

Director, Geophysical Laboratory, Carnegie Institution, Washington, D. C.

There appears to be a better opportunity for the study of earth movements in considerable variety in California than in any other locality, except Japan. It is a region of complex geologic structure, and great differences of elevation (loading) resulting in gravitation anomalies and land slips of considerable magnitude. It is proposed to study these (1) through astronomical observations of latitude for the detection of crustal creep, (2) through accurate triangulation and precise levels for the determination of local surface movements, (3) through special seismometric apparatus now building for the determination of sub-surface movement, including the place of origin of earthquake tremors, their direction of propagation and magnitude with reference to the existing faulting, (4) the location of major fault scarps off the coast which may contribute to these movements.

Thursday, October 26, 1922—"Highspeed Photography of Vibrations" (Sound, Mechanical, Electrical, etc.)

By AUGUSTUS TROWBRIDGE, PH.D., D.S.M., D.S.O., Chev. L.H., Professor of Physics, Princeton University, Princeton, New Jersey

The lecturer will discuss first the essential instrumental features which should be embodied in both the recording and the indicating members of apparatus designed to record accurately minute and rapid vibrations.

Following this he will illustrate by means of lantern slides how these features have been incorporated in a satisfactory practical working instrument. The instrument itself will be shown and records of simple and complicated vibrations will be made during the course of the lecture.

Finally the lecturer will illustrate by means of lantern slides an important use to which the instrument has been put during the past two years; viz: the study of the pressure and volume changes in the cylinder of the modern high speed internal combustion engine. (Automobile engine under varying conditions of fuel mixture, spark setting and speed.)

Thursday, November 2, 1922—"The Spectrum of Neutral Helium and the Behavior of Its Two Electrons."

By LUDWIK SILBERSTEIN, PH.D., Research Laboratory, Eastman Kodak Company, Rochester, N. Y.

After a short description of the principles of modern spectroscopic theory the lecturer will give an account of his investigations on the spectrum lines of neutral helium tending to show that the majority of these lines can be accounted for by assuming that the two electrons in a helium atom do not disturb each other to any appreciable extent, either electron being mainly controlled by the nucleus only. The subject is of especial interest, as hitherto none of these spectrum lines has been accounted for theoretically and as the said behavior of the electrons throws some curious light upon the problem of atomic structure in general.

Thursday, November 9, 1922—"Structural Colors in Feathers."

By WILDER D. BANCROFT, PH.D.

World War Memorial Professor of Physical Chemistry, Cornell University, Ithaca, New York.

Reds, yellows, and blacks are pigment colors in feathers, while whites, blues, greens, and all the metallic colors are structural colors. A brief account of structural colors is given and it is then shown that the non-metallic blues are Tyndall blues and are due to the scattering of light by minute air bubbles in the walls of the cells. Non-metallic greens are structural blues with a superposed layer of pigment yellow.

The metallic colors are interference colors, being due to thin films. There is no bright-colored pigment in the feathers of the peacock or of the

humming-bird. Michelson's theory of selective reflection is shown to be wrong, Rayleigh's theory being the right one.

Illustrated by lantern slides and exhibits.

Wednesday, November 15, 1922—"Animal Luminescence."

BY E. NEWTON HARVEY, PH.D

Professor of Physiology, Princeton University, Princeton, New Jersey.

The lecture will review the general facts of animal luminescence, the physical nature of animal light, its relation to inorganic luminescences, and the chemical processes underlying its production. Special attention will be given to the factors determining the intensity of luminescence and the possibility of obtaining a continuous luminescence will be discussed.

Illustrated by lantern slides and with demonstrations.

Thursday, November 23, 1922—"Recent Aeronautic Investigations and the Airplane Industry."

BY JOSEPH S. AMES, PH.D., LL.D., Professor of Physics, The Johns Hopkins University, Baltimore, Maryland; Director, Office of Aeronautical Intelligence, National Advisory Committee for Aeronautics.

The purpose of this lecture will be to show how experimental researches conducted primarily with reference to the development of the science of aerodynamics have an immediate application in the airplane industry. The special investigations to be discussed will be:

(a) The distribution of forces over the various surfaces of an airplane, leading to new modes of construction.

(b) The description of the motion of an airplane in maneuvers, leading to a method for testing the performance of a new airplane and for training an airplane pilot.

(c) The study of the scale effect in aerodynamics, leading to a method by which the properties of an airplane may be predicted from a knowledge of those of a model.

Illustrated fully by lantern slides.

Thursday, December 7, 1922—"Recent Advances in Photographic Theory."

BY C. E. KENNETH MEES, D.Sc.,

Director of Research Laboratory, Eastman Kodak Company, Rochester, N. Y.

A good deal of study in the last few years has been devoted to the structure of the sensitive surface of photographic materials. This surface is composed of individual crystalline grains, having a considerable range of sizes. The distribution of the grains of different sizes has been investigated and curves obtained which can be related to the photographic properties of the materials. Much work has been done on the nature of sensitiveness and of

the latent image which is produced by the action of light upon the grains. Some workers hold that the grains contain centers of sensitiveness formed when they are made, while others consider that centers are produced by the action of the light, one theory being that light acts in discrete units, each unit having the energy of a quantum. These various theories are discussed and suggestions made for further work upon the subject.

Illustrated by lantern slides.

Thursday, December 14, 1922—"The Earliest Apparatus and Procedures of Photography: Contributions to The Centenary of Modern Photographic Methods."

BY HENRY LEFFMAN, A.M., M.D., Lecturer on Research.

Philadelphia College of Pharmacy and Science, Philadelphia, Pennsylvania.

Making pictures by the use of a camera dates from the invention of the Daguerreotype, announced in 1839, but Niépce had produced a picture by contact under the influence of light in 1822. Long prior to that period the fact that light changes various substances had been discovered. The lecture will be an outline of these earlier discoveries, both as regards cameras and procedures and will be illustrated with experiments and lantern slides.

Wednesday, December 20, 1922—"Unsolved Problems of Cosmical Physics."

BY W. F. G. SWANN, D.Sc.

Professor of Physics, University of Minnesota, Minneapolis, Minnesota.

A discussion of the status of our knowledge of the earth's magnetic and electric phenomena. The origins of magnetic storms, earth-currents, the aurora borealis, and their relations to the sun's activity.

The status of our knowledge of the origin of gravitation and the bearing of Einstein's Theory upon gravitational phenomena.

Thursday, January 11, 1923—"The Principles of Electrical Vibration Instruments."

BY A. E. KENNELLY, D.Sc.

Professor of Electrical Engineering, Harvard University and Massachusetts Institute of Technology, Cambridge, Mass.

These instruments are not only important from the practical standpoint, owing to their extensive every-day use, but their working theory bears remarkable analogies to alternating electric current theory. Some of these analogies are already known, but use is made of the motional-impedance circle for analyzing the behavior of these instruments comparatively. The principles of electrical vibration instruments, therefore, commend themselves to the notice of both mechanical engineers and electrical engineers. The lecture is illustrated by lantern slides showing the experimental methods which have been employed in the analysis.

Wednesday, January 17, 1923—"Building Acoustics."

BY E. A. ECKHARDT, PH.D.

Physicist, Bureau of Standards, Department of Commerce, Washington, D. C.

With the development of fireproof building construction, the requirements of satisfactory accoustical conditions have been increasingly difficult to meet. The lecture will outline the chief problems of acoustics which are encountered in the construction and furnishing of public buildings and homes. The degree to which our present knowledge permits predetermination of acoustical properties of structures from their design will be discussed. The direction and extent of present-day research along building acoustic lines will be briefly reviewed. Illustrated by lantern slides.

Thursday, January 25, 1923—"The Physics and Chemistry of Plant Life."

BY RODNEY H. TRUE, PH.D.

Professor of Botany, University of Pennsylvania, Philadelphia, Pennsylvania.

Methods of physical sciences used in study of plant life processes. Investigation of these processes has aided the method sciences. Osmotic studies of botanist Pfeffer, add to newer theory of solutions. Plant cell an osmotic system in which the living substance forms the semi-permeable membrane, the cell wall carrying the load. Osmotic energy due to mixture of molecules and ions. Does the living membrane exert a selective action? Bearing of answer on plant nutrition. Plant cell maintains an osmotic surplus over environment. How secured and how maintained. Wilting and osmotic pressure. Cell growth and osmotic pressure.

Thursday, February 1, 1923—"Motion Picture Photography for the Amateur."

BY C. E. K. MEES, D.Sc.,

Director of Research Laboratory, Eastman Kodak Company, Rochester, N. Y.

While the history of photography shows that most of the new developments have been due to the work of amateurs, the field of the motion picture has largely been closed to those outside the professional ranks. This has been due partly to the lack of suitable apparatus, but even more to the high cost of taking and printing the films. The use of very small pictures and narrow width films has hitherto involved a serious sacrifice in the quality of the pictures obtained. A new development of a special film and a method of producing positives directly by reversal during development makes it possible to get small pictures of the highest quality at a very low cost. Suitable cameras and projectors have been designed for this new film.

The lecture will be illustrated by lantern slides and by the projection of motion pictures by means of the new apparatus.

Thursday, February 8, 1923—"Tidal and Current Work of the Coast and Geodetic Survey."

By G. T. RUDE, Lieutenant Commander; Chief, Division of Tides and Currents,
U. S. Coast and Geodetic Survey, Washington, D. C.

An outline will be made of the activities of the Coast and Geodetic Survey in tidal and current work, with special reference to recent investigations in the subject of wind-driven currents.

A non-mathematical explanation of the forces governing the making of the tides and currents and examples of the different types of tides and currents.

Relation and importance of tides and currents to the work of the engineer, mariner and scientist.

A brief description of the instruments and methods employed in the observation and prediction of tides and currents.

Illustrated by lantern slides.

Thursday, February 15, 1923—"The Structure and Constitution of Alloys."

By WALTER ROSENHAIN, D.Sc., F.R.S.

Superintendent, Metallurgy Department, The National Physical Laboratory,
Teddington, England

Emphasizing the increasing importance of full detailed knowledge of the internal structure and constitution of alloys, the lecture will review the methods of studying structure and constitution which have been recently developed, and some of the more important results obtained. The methods dealt with will include those relating to the thermal study of alloys by means of heating and cooling curves, and their interpretation. Principal importance, however, attaches to the microscopic examination of alloys in various states obtained by special methods of preparation, including prolonged annealing at carefully controlled temperatures, very gradual cooling, and quenching from accurately-known temperatures. The applications of these methods to the fundamentally important problem of determining the solubility of metals in one another in the solid state, and to the study of ternary and other complex alloys, will be described, with special reference to alloys of aluminum whose structure, constitution and properties have recently been investigated in the lecturer's laboratory.

Illustrated by lantern slides.

Wednesday, February 21, 1923—"The Main Piers of the Bridge over the Delaware River, between Philadelphia and Camden."**I—DESIGN**

By CLEMENT E. CHASE, C.E.,

Principal Assistant Engineer, Delaware River Bridge Joint Commission

The great main towers of the bridge, rising 380 feet above high tide in the Delaware, are to be supported on granite and concrete piers, starting from

the bed rock. To secure this foundation, two of the largest pneumatic caissons ever used in a bridge foundation were required. These embodied fundamental changes in design, based on experience with previous large caissons, and marked a considerable step in the development of the type in American practice, as shown by comparison with the caissons used in other important bridges. Recognition of the necessity for reducing the risks to the compressed air workers was reflected in provision of emergency refuge chamber, use of air locks large enough to hold an entire shift, and in the safety requirements of the specifications.

II—CONSTRUCTION

By M. B. CASE, B.Sc.,

Senior Resident Engineer, Delaware River Bridge Joint Commission

The proximity of large shipyards made it possible to build the pneumatic caissons complete, ready for sinking, on shipways, capable of launching a battleship. This situation contrasted with other conditions, frequently encountered.

The enormous area of the caissons made it desirable to keep the unit pressures at the cutting edge as small as possible during sinking, to avoid excessive warping and racking stresses in the caisson structure. Procedure to accomplish this condition described.

The ample equipment of hoisting shafts and air locks with convenient disposal of muck into barges alongside made for relatively rapid sinking.

Medical examinations and attention for compressed air workers outlined, with records of results accomplished.

The plant and methods used for the construction of massive granite ashlar masonry described.

Illustrated by lantern slides.

Joint Meeting with Philadelphia Section, American Society of Civil Engineers.

Thursday, March 1, 1923—"High Temperature Investigation."

By EDWIN F. NORTHRUP, Ph.D.

Member of The Institute.

The advantages derived by examining the properties of matter under extreme artificial conditions—extreme forces, extreme temperatures.

Nature and meaning of temperature and contrasts in the properties of matter when at low and high temperature will be briefly considered.

Scientific and industrial necessity shown for studying matter at high temperature free from chemical contamination.

The available tools for high temperature research, and the freedom from ordinary limitations considered when temperature is obtained by influx of electromagnetic energy.

Possibilities mentioned and results already obtained by using high frequency induction.

Demonstration of heating with ironless induction.

Some problems of high temperature research listed and a plea made for increase of interest in this subject.

Thursday, March 8, 1923—"Ionization and Resonance Phenomena."

BY CHARLES B. BAZZONI, Ph.D.

Professor of Experimental Physics, University of Pennsylvania,
Philadelphia, Pa.

The modern theories of atomic structure in which the properties of materials are related to the groupings of electrons in the atoms are to a large extent checked experimentally by determinations of ionization and resonance potentials. These quantities are intimately connected with the structure and stability of the atoms and with the production of the ordinary optical spectra.

The speaker will outline briefly the development of the dynamic theories of atomic constitution including recent refinements. Certain experimental methods used to investigate the stability of atomic and molecular systems will then be described and discussed, and finally the way in which the production of spectral series depends upon the electronic arrangements will be brought out. The attempt will be made to show in a non-technical way the state of our knowledge in this rapidly changing field at the time of the lecture.

Illustrated by lantern slides.

Thursday, March 15, 1923—"Radiation and Chemical Reaction."

BY HERBERT S. HARNED, Ph.D.

Assistant Professor of Physical Chemistry, University of Pennsylvania,
Philadelphia, Pennsylvania.

Chemical reaction velocities in general. Monomolecular reactions and their temperature coefficients. Theories of Arrhenius, Marcellin and Rice. Thermal radiation theory of chemical reaction developed by W. C. McC. Lewis, Perrin, Tolman, Dushman and others. Reactions stimulated by visible and ultra violet radiation. The Einstein photochemical equivalent law. Are all chemical reactions photochemical?

Illustrated by lantern slides.

Wednesday, March 21, 1923—"Measuring Ocean Depths by Acoustical Methods."

BY HARVEY C. HAYES, Ph.D., Research Physicist, U. S. Navy

This lecture will deal in general with the measurement of distances by acoustical methods and in particular with the measurement of submarine distances and the determination of submarine contours. The history of the

subject will be briefly outlined and the various devices that have been developed in connection with the problem will be described. The research work carried out by the Navy during the past five years, which has resulted in solving the problem of measuring submarine distances through the development of "The Sonic Depth Finder" will be reviewed. Contour charts of the sea-bottom to depths exceeding three thousand fathoms will be shown and certain possible interesting and valuable applications of this device will be mentioned.

Illustrated by lantern slides.

Thursday, March 29, 1923—"Physical Measurements of Audition and Their Bearing upon the Theory of Hearing."

BY HARVEY FLETCHER, PH.D.

Research Laboratories of the American Telephone and Telegraph Company and the Western Electric Company, Incorporated, New York City.

Until recently accurate measurements in audition have been extremely difficult, but the advent of the vacuum tube and high quality telephone transmitters and receivers has given us some powerful tools for work in this field.

With these instruments it has been possible to establish definite boundary lines for the auditory sensation area on the pitch-intensity plane for normal hearing and for different degrees of deafness.

Quantitative measurements of the masking effect of one pure tone upon another have furnished data from which the vibratory characteristics of the basilar membrane of the internal ear have been calculated.

Loudness has been given a definite numerical meaning and from measurements of the interfering effect of the presence of complex tones and noises upon the ability to hear simple tones or interpret speech, some empirical laws of loudness have been formulated which have interesting engineering applications.

Illustrated by lantern slides.

Thursday, April 5, 1923—"The Theory of Light and Vision."

BY JAMES P. C. SOUTHALL, A.M.

Professor of Physics, Columbia University, New York City, New York.

On the theory of light and vision, particularly in the fields of geometrical optics and physiological optics. An historical and critical survey of optical science, especially of its beginnings in the seventeenth century (Kepler, Scheiner, Descartes, Newton, Huygens, etc.); progress in theoretical and technical optics in the nineteenth century (Young, Fraunhofer, Helmholtz, Donders, Abbe, etc.); present status of optics with particular reference to the remarkable theories of Gullstrand.

Monday, April 9, to Friday, April 13, 1923, inc.—“The Electron in Chemistry.”

BY SIR JOSEPH JOHN THOMSON,
O.M., F.R.S., LL.D., Ph.D., D.Sc.,
Master of Trinity College,
Cambridge, England

Monday, April 9, 1923—Lecture 1.

The Atomic Theory had little effect on the progress of chemistry as long as nothing was known about the structure of the atom. The discovery of the electron showed that atoms have a structure and gave a clue to its character. The arrangement of the electrons in the atom. Number of electrons in the atom. Electronic Isomers. Active nitrogen. Instability of configuration when electrons are too crowded. Eight the maximum number of electrons which can be on the outer layer of an uncharged atom. This result involves a periodicity in the properties of the atoms of the different elements such as is expressed by Mendeleef. Periodic Law. Valency. The size of atoms. Specific Inductive capacity. Work required to abstract an electron from an atom. Methods for testing the configuration of electrons in an atom.

Tuesday, April 10, 1923—Lecture 2.

The combination of atoms to form molecules. Physical interpretation of chemical “bonds.” Double bonds. Union of two similar atoms to form a molecule. Union of two or more dissimilar atoms. “Positive and negative” valencies. Arrangement of electrons in Octets. Comparison with the results of the old valency rules. Stability of systems of Octets. Instability chains of Octets in general. Stability of CH_2 chains. Polar molecules. Importance of these in chemical reactions. Problem of the water molecule. Arrangement of the electrons in chlorides, chlorates, perchlorates, carbonates, sulphates, sulphites, nitrates, nitrites. Connection between the arrangement of the electrons and the acidic or basic properties of the compound.

Wednesday, April 11, 1923—Lecture 3.

Mechanism of chemical combination. Active *molecules*. Their occurrence in such reactions as the combination of hydrogen with chlorine or of oxygen with hydrogen. Afford a physical basis for Thiele's theory of partial valencies. “Molecular compounds.” “Residual Affinity.” Double salts. Electron Theory gives a physical basis for Werner's Co-ordination Theory. Mechanism of Electrolytic Dissociation. Structure of the ions in liquids. Catalytic Action. Variable Valency and Homologous Elements.

Thursday, April 12, 1923—Lecture 4.

Connection between variable valency and the magnetic properties of the elements. Magnetism of chemical compounds. Magnetism of oxygen. Dia-

magnetism affords a method of checking the configuration of the atom and the migration of the electrons in chemical combination. The electron theory of solids. General considerations. Calculation of the energy of a solid.

Friday, April 13, 1923—Lecture 5.

The calculation on the Electron Theory of the compressibility of the elements in a solid state. Critical periods of vibration for solids. Latent heat of evaporation. Compressibility and specific Inductive Capacity of Salts. The structure of metals, salts, and insulators. Electrical conductivity of metals.

Wednesday, April 18, 1923—"The Cathode Ray Oscillograph and Its Application to the Exact Measurement of Explosion Pressures, Potential Changes in Vacuum Tubes, and Magnetos."

By D. A. KEYS, PH.D.

Department of Physics, McGill University, Montreal, P. Q., Canada.

The special form of cathode ray oscillograph used in these investigations was devised during the war by Sir Joseph J. Thomson, O. M., for use in conjunction with the piezoelectric properties of crystals to measure the very rapid and large variations of pressure due to an explosion in water.

The method consists in placing in the water near the explosion, a special form of crystal detector which transforms the pressure variations into corresponding changes in electrical charge by virtue of the piezoelectric properties of the crystals. These electrical variations act upon a beam of moving electrons which are magnetically controlled in the oscillograph, and this beam falling directly on a photographic plate traces out the time-pressure history of the explosion. The arrangement is thus a pressure recording device of negligible inertia and is the only method known of determining exactly the maximum pressure in water produced by an explosion of guncotton, T. N. T. or other high explosive. With this form of oscillograph changes which take place in one fifty thousandth of a second have been measured. Among the many possible applications of this instrument to Physical and Engineering investigations, mention will be made of recent work on the rise of potential in vacuum tubes at the beginning of the discharge. The same scheme may be used in the study of specific heats of gases at high temperatures and in the investigation of the characteristics of a magneto. The lecture will be illustrated with lantern slides and some experiments.

Wednesday, May 16, 1923—Awarding of Franklin Medals and Conferring of Honorary Memberships.

TERMS AND PRIVILEGES OF MEMBERSHIP

The members of the Institute are divided into the following classes, viz.: *Resident Members, Stockholders, Life Members, Permanent Members, Non-resident and Associate Members.*

Any one interested in the purposes and objects of the Institute and expressing a willingness to further the same may become a member when proposed by a member in good standing and elected by the Board of Managers.

Terms.—Resident members pay Fifteen Dollars each year. The payment of Two Hundred Dollars in any one year secures Life Membership, with exemption from annual dues.

Stock.—Second-class stockholders pay an annual tax of Twelve Dollars per share, and the holder of one share is entitled by such payment to the privileges of membership.

Privileges.—Each contributing member (including non-residents) and adult holder of second-class stock is entitled to participate in the meetings of the Institute, to use the Library and Reading Room, to vote at the Annual Election for officers, to receive tickets to the lectures for himself and friend, to attend the Section meetings and to receive one copy of the JOURNAL free of charge, except associate members, who may not take part in elections.

Permanent Members—The Board of Managers may grant to any one who shall in any one year contribute to the Institute the sum of One Thousand Dollars a permanent membership, transferable by will or otherwise.

Non-resident Members.—Newly elected members residing permanently at a distance of twenty-five miles or more from Philadelphia may be enrolled as Non-resident Members, and are required to pay an entrance fee of Five Dollars, and Five Dollars annually. Non-resident Life Membership, \$75.00.

Contributing members, if eligible, under the non-resident clause, on making request therefor, may be transferred to the non-resident class by vote of the Board of Managers, and are required to pay Five Dollars annually.

Associate Members.—Associate members are accorded all the privileges of the Institute, except the right to vote or hold office, upon the payment of annual dues of Five Dollars. This class of membership is limited to persons between the ages of seventeen and twenty-five years. Upon reaching the age limit they become eligible to the other classes of membership.

Resignations must be made in writing, and dues must be paid to the date of resignation.

MEMBERSHIP DIRECTORY

HONORARY MEMBERS

- Brigadier General JAMES ALLEN, U. S. A. (Retired), Army and Navy Club, Washington, D. C.
- Colonel GEORGE L. ANDERSON, U. S. A. (Retired).
- Prof. SVANTE AUGUST ARRHENIUS, Nobel Institute, Stockholm, Sweden.
- Brigadier General JOHN J. CARTY, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
- Prof. CHARLES F. CHANDLER, Columbia University, New York City, New York.
- Mr. THOMAS A. EDISON, Orange, New Jersey.
- Prof. CHARLES FABRY, Professor of Physics, University of Paris, 1 Rue Victor-Cousin, Paris (5e), France.
- General G. FERRIÉ, Inspecteur des Services de la Telegraphie Militaire et des transmissions, 51 bis, Boulevard Latour-Maubourg, Paris, France.
- Prof. GEORGE FORBES, No. 11 Little College Street, Westminster, S. W., London, England.
- Prof. HENDRIK A. LORENTZ, Zylweg 76, Haarlem, Holland.
- Senator GUGLIELMO MARCONI, Royal Italian Senate, Rome, Italy.
- Dr. T. C. MENDENHALL, Ravenna, Ohio.
- Dr. A. A. MICHELSON, Professor of Physics, University of Chicago, Chicago, Illinois.
- Dr. RALPH MODJESKI, 818 Widener Building, Philadelphia, Pennsylvania.
- Rear Admiral JOSEPH B. MURDOCK, U. S. N. (Retired), Danbury, New Hampshire.
- Prof. HEIKE KAMERLINGH ONNES, University of Leiden, Leiden, Holland.
- Hon. Sir CHARLES A. PARSONS, 6 Windsor Terrace, Newcastle-On-Tyne, England.
- General JOHN J. PERSHING, War Department, Washington, D. C.
- Mr. RALPH W. POPE, 570 Cherry Street, Elizabeth, New Jersey.
- Prof. THEODORE WILLIAM RICHARDS, Wolcott Gibbs Memorial Laboratory, Harvard University, Cambridge, Massachusetts.
- Rear Admiral WILLIAM S. SIMS, U. S. N., General Board, Naval War College, Newport, Rhode Island.
- Mr. FRANK J. SPRAGUE, Consulting Engineer, President, Sprague Safety Control & Signal Corporation, 421 Canal Street, New York City, New York.
- Major-General GEORGE OWEN SQUIER, War Department, Washington, D. C.
- Rear Admiral DAVID WATSON TAYLOR, U. S. N., 1813 19th Street, N. W., Washington, D. C.
- Sir JOSEPH J. THOMSON, Trinity College, Cambridge, England.
- Prof. WILLIAM CAWTHORNE UNWIN, Palace Gate Mansions, Kensington, London, England.
- Dr. H. W. WILEY, Room 1120, Woodward Building, Washington, D. C.

CORRESPONDING MEMBERS

- Professor A. S. EVE, McGill University, Montreal, Canada.
- Mr. T. COMMERFORD MARTIN, 32 Grove Avenue, Larchmont Manor, New York.
- Prof. JOHN SEALY TOWNSEND, New College, Oxford, England.

IN MEMORIAM

- Mr. ISAAC B. THORN.

MEMBERS

- ABBOTT, ROBERT R., Metallurgical Engineer, The Peerless Motor Car Company, Cleveland, Ohio.
- ACHESON, Dr. EDWARD G., Manufacturer, Acheson Corporation, Æolian Building, 35 West 42nd Street, New York City, New York.
- ADAMS, HOWARD L., Managing Director, Keystone Institute, Reading, Pennsylvania.
- ADAMS, MERRITT H., Works Manager, Vim Motor Company, 23rd & Market Streets, Philadelphia, Pennsylvania.
- ADDICKS, ALLEN, Engineer, Musician, 106 South 36th Street, Philadelphia, Pennsylvania.
- ADDICKS, WALTER R., President, Consolidated Gas Company of New York, 130 E. 15th Street, New York City, New York.
- ADSIT, CHARLES G., Engineer 555 Electric and Gas Building, Atlanta, Georgia.
- AKELEY, CARL E., Taxidermist and Sculptor, American Museum of Natural History, 77th Street and Central Park West, New York City, New York.
- AKIMOFF, NICHOLAS W., Mechanical and Hydraulic Engineer, 1013 Harrison Building, Philadelphia, Pennsylvania.

- ALBRECHT, A. C.**, Vice President, North Manufacturing Company, Lehigh Avenue and American Street, Philadelphia, Pennsylvania.
- ALLAN, ANDREW, JR.**, Manufacturer of Bearing Metals, Harrison, New Jersey.
- ALLEMAN, GELLERT**, Professor of Chemistry, Swarthmore College, and for mail, 8 Whittier Place, Swarthmore, Pennsylvania.
- ALLEN, HENRY B.**, Metallurgical Engineer, 8112 St. Martin's Lane, Chestnut Hill, Philadelphia, Pennsylvania.
- ALLEN, JAMES**, Brigadier General, U. S. A., Army and Navy Club, Washington, D. C.
- ALLEN, WILLIAM N.**, Retired Chemical Manufacturer, 557 Church Lane, Germantown, Philadelphia, Pennsylvania.
- ALSBERG, DR. CARL L.**, Stanford University, California.
- AMES, DR. JOSEPH S.**, Director Physical Laboratory, The Johns Hopkins University, Baltimore, Maryland.
- ANDERSEN, OLAF**, Geologist, Norges Geologiske Undersokilse, Kronprinsensgt 2, Kristiania, Norway.
- ANDERSON, FRANK**, Mining Engineer, 1172 Harvard Avenue, Salt Lake City, Utah.
- ANDERSON, Colonel GEORGE L.**, U. S. A., Electrical Engineer, Address unknown.
- ANDERSON, ROBERT J.**, Metallurgical Engineer, U. S. Bureau of Mines, Experiment Station, Pittsburgh, Pennsylvania.
- ANDREAU, ROLAND L.**, Consulting Chemical Engineer and Research Chemist, Laurel Springs, New Jersey.
- ANDREWS, W. S.**, Consulting Electrical Engineer, General Electric Company, Schenectady, New York.
- ANGERER, VICTOR**, Vice President, Taylor-Wharton Iron and Steel Company, P. O. Box 162, Ridley Park, Pennsylvania.
- ARMSTRONG, WILLIAM R.**, Clerk, Powers-Weightman-Rosengarten Company, Philadelphia, Pennsylvania.
- ARNOLD, Dr. H. D.**, Director of Research, Engineering Department, Western Electric Company, New York City, N. Y.
- ARNY, Dr. H. V.**, Teacher and Chemist, 115 West 68th Street, New York City, New York.
- ARRHENIUS, SVANTE AUGUST**, Physicist, Nobel Institute, Stockholm, Sweden.
- ASEF, Dr. WALDEMAR**, Research Chemist, Research Department, Pennsylvania Salt Manufacturing Company, Greenwich Point, Philadelphia, Pennsylvania.
- ASHBROOK, Dr. DONALD S.**, Chemist, 2404 Willard Street, Wilmington, Delaware.
- ASHHURST, John**, Librarian, The Free Library of Philadelphia, 13th and Locust Streets, Philadelphia, Pennsylvania.
- ASHMEAD, FRANK M.**, Civil Engineer, The Locust, Pennsylvania Avenue, Atlantic City, New Jersey.
- ATKINSON, ROBERT**, Instructor in Chemistry, Haverford College, Haverford, Pennsylvania.
- ATLEE, JOSHUA W.**, Naval Architect, William Cramp and Son's Ship and Engine Building Company, and for mail, Riverton, New Jersey.
- ATLEE, WALTER**, Civil Engineer, 218 East 20th Street, Baltimore, Maryland.
- ATTERBURY, W. W.**, Brigadier-General, Vice President, Pennsylvania Railroad Company, Broad Street Station, Philadelphia, Pennsylvania.
- ATWATER, RICHARD M. Jr.**, Consulting Mining Engineer, Scarsdale, New York.
- AUSTIN, Dr. LOUIS W.**, U. S. Naval Radio Research Laboratory, Bureau of Standards, Washington, D. C.
- AUSTIN, W. L.**, Vice Chairman of the Board, The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- AYRES, EUGENE E., JR.**, Chemical Engineer, Sharpes Specialty Company, 23rd and Westmoreland Streets, Philadelphia, Pennsylvania.
- BACHE, DANIEL T.**, Student, 2102 Pine Street, Philadelphia, Pennsylvania.
- BACON, Dr. RAYMOND FOSS**, Chemical Engineer, Chemists Building, 50 East 41st Street, New York City, New York.
- BAEKELAND, Dr. L. H.**, Research Chemist, Snug Rock, Harmony Park, Yonkers-on-Hudson, New York.
- BAKER, FRANKLIN, Jr.**, Manufacturer Wayne Avenue and Hortter Street, Germantown, Philadelphia, Pennsylvania.
- BAKER, GEORGE FALES**, Physician, 403 Lafayette Building, Philadelphia, Pennsylvania.
- BALCH, ALFRED C.**, Publisher, 227 South 6th Street, Philadelphia, Pennsylvania.
- BALCH, EDWIN S.**, Attorney-at-Law, 1634 Spruce Street, Philadelphia, Pennsylvania.
- BALDWIN, FREDERIC E.**, (Retired) 2200 Walnut Street, Philadelphia, Pennsylvania.
- BALLARD, R. H.**, Vice President and Assistant General Manager, Southern California Edison Company, Edison Building, Los Angeles, California.
- BALLENTINE, WILLIAM I.**, Vice President, Advance Rumely Company, La Porte, Indiana.
- BALLINGER, WALTER F.**, Architect, Twelfth and Chestnut Streets, Philadelphia, Pennsylvania.
- BALLS, Prof. WILLIAM H.**, 1422 Snyder Avenue, Philadelphia, Pennsylvania.

- BANCROFT, JOHN, Manufacturer, Wilmington, Delaware.
- BANCROFT, JOSEPH, Vice President and Treasurer, Joseph Bancroft and Sons, Wilmington, Delaware.
- BANNISTER, J. C., Lock Box 26, Boston, Massachusetts.
- BARNES, JAMES, Professor of Physics, Bryn Mawr College, Bryn Mawr, Pennsylvania.
- BARNES, JOHN HAMPTON, Attorney-at-Law, Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- BARNETT, EDWIN S., Wheat Starch Manufacturer, 7011 Cresheim Road, Mt. Airy, Philadelphia, Pennsylvania.
- BARNHART, G. EDWARD, Aeronautical Engineer, 191 Marion Avenue, Pasadena, California.
- BARR, Major JOHN H., Mechanical Engineer, The Barr-Morse Corporation, Ithaca, New York.
- BARRINGER, DANIEL MOREAU, Geologist and Mining Engineer, 1242 Real Estate Trust Building, Philadelphia, Pennsylvania.
- BARTH, CARL G., Consulting Engineer, Room 216, 10 South 18th Street, Philadelphia, Pennsylvania.
- BARTOW, EDWARD, Chemistry Department, State University of Iowa, Iowa City, Iowa.
- BASFORD, G. M., President, Locomotive Feed Water Heater Company, Room 719, 17 East 42nd Street, New York City, New York.
- BASHORE, E. GORGAS, Consulting Chemical Engineer, The Texas Company, Port Arthur, Texas.
- BASSETT, WILLIAM H., Technical Superintendent, American Brass Company, Waterbury, Connecticut, and for mail, Cheshire, Connecticut.
- BATES, C. W., Electrical Engineer, Philadelphia Electric Company, and for mail, 403 N. Narberth Avenue, Narberth, Pennsylvania.
- BATES, ONWARD, Civil Engineer, 332 South Michigan Avenue, Chicago, Illinois.
- BEACH, CHARLES S., Designer and Machinist, 745 Main Street, Bennington, Vermont.
- BEALE, HORACE A., JR., President, Parkesburg Iron Company, Parkesburg, Pennsylvania.
- BEALE, LEONARD, T., Secretary, John T. Lewis & Brother Company, 705 Lafayette Building, Philadelphia, Pennsylvania.
- BEATH, E. R., Lapidist and Jeweler, 129 South 12th Street, Philadelphia, Pennsylvania.
- BECK, M. A., Vice President and Chief Engineer, Milwaukee Electric Crane and Manufacturing Company, 294 Greenbush Street, Milwaukee, Wisconsin.
- BECKER, IRWIN A., Pharmacist, in care of Michael Reese Hospital, 2839 Ellis Avenue, Chicago, Illinois.
- BELFIELD, T. BROOM, Manufacturer, 1905 Spring Garden Street, Philadelphia, Pennsylvania.
- BELL, J. SNOWDEN, Attorney-at-Law, 129 Broadway, New York City, New York.
- BEMENT, WILLIAM P., (Retired), 743 Real Estate Trust Building, Philadelphia, Pennsylvania.
- BENNETT, C. E., Engineering Department, Georgia Railway and Power Company, Atlanta, Georgia.
- BENNETT, FREDERICK M., Mechanical and Electrical Engineer, 2516 Harlan Street, Philadelphia, Pennsylvania.
- BENZON, GEORGE H., JR., Mechanical Engineer, 252 Mather Road, Jenkintown, Pennsylvania.
- BERG, ERNST J., Professor of Electrical Engineering, Union College, Schenectady, New York.
- BERG, HOLGER V., Chemical Engineer, Newport, Delaware.
- BERLINER, EMILE, Engineer, 1458 Columbia Road, Washington, D. C.
- BERLINER, HERBERT S., Engineer, Compo Company, Ltd., 131 18th Avenue, Lachine, Canada.
- BERRESFORD, A. W., General Manager, The Cutler-Hammer Manufacturing Company, and for mail 303 Hotel Astor, Milwaukee, Wisconsin.
- BIDDLE, CHARLES M., JR., First Vice President, Supplee-Biddle Hardware Company, 517 Commerce Street, Philadelphia, Pennsylvania.
- BIDDLE, ELIZABETH C., 400 South 15th Street, Philadelphia, Pennsylvania.
- BIDDLE, JAMES G., Importer of Scientific Apparatus, Wallingford, Pennsylvania.
- BIDDLE, ROBERT, President, Biddle-Gaumer Company, 3846-56 Lancaster Avenue, Philadelphia, Pennsylvania.
- BIERBAUM, CHRISTOPHER H., Consulting Engineer, 1011 Mutual Life Building, Buffalo, New York.
- BIGELOW, S. LAWRENCE, Professor of General and Physical Chemistry, University of Michigan, Ann Arbor, Michigan.
- BILGRAM, HUGO, Machinist, 1235 Spring Garden Street, Philadelphia, Pennsylvania.
- BILLINGS, A. W. K., Civil, Mechanical and Electrical Engineer, Canadian and General Finance Company, Limited, 357 Bay Street, Toronto, Canada.
- BILLOW, CLAYTON O., Consulting Engineer, 1431 Jarvis Avenue, Rogers Park, Chicago, Illinois.
- BILYEU, THOMAS, Mechanical Engineer, 697 E. Broadway Street, Portland, Oregon.
- BINDER, RICHARD L., President, K. & B. Company, Special Electrical Supplies, 931 North 8th Street, Philadelphia, Pennsylvania.

- BINNS, ARTHUR W.**, Steam Engineer, Morton, Pennsylvania.
- BIRCH, GEORGE W., JR.**, Chemist, 19 Fairview Avenue, Highland Park, Delaware County, Pennsylvania.
- BIRKINBINE, CARL PETER**, Engineer, Room 800, Commercial Trust Building, Philadelphia, Pennsylvania.
- BLACKBURN, ARTHUR**, Grain Merchant, 315 Chamber of Commerce, and for mail, 5905 York Road, Baltimore, Maryland.
- BLACKBURN, CAROLINE D.**, Chemist, 7028 Paschall Avenue, Philadelphia, Pennsylvania.
- BLAIR, A. A.**, Analytical Chemist, 406 Locust Street, Philadelphia, Pennsylvania.
- BLATZ, FREDERICK J.**, Leather Manufacturer, P. O. Box 967, Wilmington, Delaware.
- BLUM, ARTHUR N.**, Mechanical Engineer, Delmar-Morris Apartments, Germantown, Philadelphia, Pennsylvania.
- BODINE, SAMUEL T.**, President, the United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- BOEKEL, J.**, Manufacturer of Metal Goods, 518 Vine Street, Philadelphia, Pennsylvania.
- BOERICKE, FELIX A.**, (Retired), Bryn Athyn, Pennsylvania.
- BOERICKE, GIDEON**, Civil Engineer, Wynnwood, Pennsylvania.
- BOERICKE, JOHN J.**, Metallurgist, Secretary, Primos Chemical Company, and for mail, Merion, Pennsylvania.
- BONINE, CHARLES E.**, Consulting and Designing Engineer, Franklin Trust Building, 20 South 15th Street, Philadelphia, Pennsylvania.
- BOOZ, H. C.**, Chief Engineer, Berwind-White Coal Mining Company, 1100 Commercial Trust Building, Philadelphia, Pennsylvania.
- BORIE, BEAUVEAU, Jr.**, Investment Broker, 511 Chestnut Street, Philadelphia, Pennsylvania.
- BORIE, RENSHAW**, Engineer, McClellan & Junkersfeld, 112 South 16th Street, Philadelphia, Pennsylvania.
- BORTON, GEORGE W.**, President and General Manager, Pennsylvania Crusher Company, 1324 Stephen Girard Building, Philadelphia, Pennsylvania.
- BOSTWICK, J. VAUGHAN**, St. Davids, Pennsylvania.
- BOURNE, GEORGE L.**, Vice President, Locomotive Superheater Company, 17 East 42nd Street, New York City, New York.
- BOWEN, SAMUEL B.**, Manufacturer, 4th Street and Sedgley Avenue, Philadelphia, Pennsylvania.
- BOWER, C. P.**, Civil Engineer, 11 Eastern Avenue, Wyndmoor, Montgomery County, Pennsylvania.
- BRADSHAW, WILLIAM HENRY**, Chemist, 38 East Essex Avenue, Lansdowne, Pennsylvania, Road, Philadelphia, Pennsylvania.
- BOYER, MURRAY C.**, Solicitor of Patents, 829 Stephen Girard Building, 21 South 12th Street, Philadelphia, Pennsylvania.
- BRADBURY, Dr. ROBERT H.**, Science Teacher, Southern High School, 2100 Shunk Street, Philadelphia, Pennsylvania.
- BRADDOCK-ROGERS, K.**, 125 West Park Avenue, Haddonfield, New Jersey.
- BRADLEY, A. J.**, Manufacturer, 101 Beekman Street, New York City, New York.
- BRADSHAW, WILLIAM HENRY**, Chemist, 38 East Essex Avenue, Lansdowne, Pennsylvania.
- BRADY, EDWARD J.**, Engineering Research, 3101 Passyunk Avenue, Philadelphia, Pennsylvania.
- BREED, GEORGE**, Consulting Engineering, 277 Harvey Street, Germantown, Philadelphia, Pennsylvania.
- BREWER, Dr. J. EDWARD**, Chemist, 215 Summit Street, Norristown, Pennsylvania.
- BRIESEN, FRITZ V.**, Attorney-at-law, 25 Broad Street, New York City, New York.
- BRIGHT, J. L.**, Architect, Devon, Pennsylvania.
- BRINLEY, CHARLES E.**, President, American Pulley Company, 4200 Wissahickon Ave., Philadelphia, Pennsylvania.
- BRINTON, RUSSELL L.**, 3700 Kensington Avenue, Philadelphia, Pennsylvania.
- BROCK, JOHN W.**, Retired Attorney, 511 Bullitt Building, Philadelphia, Pennsylvania.
- BROMLEY, JOSEPH H.**, Manufacturer, Chelton and Wissahickon Avenue, Philadelphia, Pennsylvania.
- BROWN, FRANCIS SHUNK**, Lawyer, 1005 Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- BROWN, J. STANFORD**, P. O. Box 38, Black Hall, Connecticut.
- BROWN, RICHARD P.**, President, Brown Instrument Company, Wayne and Windrim Avenue, Philadelphia, Pennsylvania.
- BROWN, T. WISTAR, 3rd**, Attorney, 230 Chestnut Street, and for mail, 5920 City Avenue, Philadelphia, Pennsylvania.
- BROWNSTEIN, BENJAMIN**, Mechanical Engineer, Elwood City, Pennsylvania.
- BRUNEL, ROGER F.**, Professor of Chemistry, Bryn Mawr College, Bryn Mawr, Pennsylvania.
- BRUNNER, FRANK A.**, Drawing Materials, 910 Filbert Street, Philadelphia, Pennsylvania.
- BRUNKER, ROBERT J.**, Banker, 1000 Walnut Street, Philadelphia, Pennsylvania.
- BRUSH, CHARLES F.**, Electrical Engineer, 3725 Euclid Avenue, Cleveland, Ohio.

- BUCHANAN, CHARLES GORDON, Mechanical Engineer, 167 North Munn Avenue, East Orange, New Jersey.
- BUCK, H. W., Consulting Engineer, 49 Wall Street, New York City, New York.
- BUDD, A. Van WYCK, Berwyn, Prince George County, Maryland
- BUDD, EDWARD G., Machinist, 502 Westview Street, Germantown, Philadelphia, Pennsylvania
- BULLOCK, WILLIAM E., Mechanical Engineer, 29 West 39th Street, New York City, New York.
- BUNNELL, STERLING H., Consulting Mechanical Engineer, 103 Park Avenue, New York City, New York.
- BUREAU, E. W., Bronze Founder, S. E. Corner 23rd and Westmoreland Streets, Philadelphia, Pennsylvania.
- BURGESS, WILLIAM J., 940 South 55th Street, Philadelphia, Pennsylvania.
- BURHORN, EDWIN, Engineer and Contractor, 938 Hudson Street, Hoboken, New Jersey.
- BURK, CHARLES A. D., Physical Chemist and Inventor, 401 Santa Rita Apartments, Atlantic City, New Jersey.
- BURLINGAME, LUTHER D., Industrial Superintendent, Brown and Sharpe Manufacturing Company, Providence, Rhode Island.
- BURNHAM, GEORGE JR. (Retired), 1400 Morris Building, Philadelphia, Pennsylvania.
- BURROUGHS, JOSEPH H., Attorney-at-Law, 612 Bullitt Building, Philadelphia, Pennsylvania.
- BURT, MILO C., Chemist, 636 Water Street, Bridgeport, Connecticut.
- BURTON, THOMAS L., Consulting Engineer, Westinghouse Air Brake Company, 165 Broadway, New York City, New York.
- BUSH, S. P., Manufacturer, The Buckeye Steel Castings Company, Columbus, Ohio.
- BUSSER, FRANK S., Attorney-at-Law, 926 Land Title Building, Philadelphia, Pennsylvania.
- BUXTON, GEORGE E., Industrial Engineer, 322 King Street, Pottstown, Pennsylvania.
- BYERS, ISAAC W., (Retired), Iron River, Michigan.
- BYRD, JOHN, Metal Worker. Address unknown.
- BYRNES, FRANK, Clerk, 535 West Montgomery Avenue, Philadelphia, Pennsylvania.
- CABOT, GEORGE E., 60 State Street, Boston, Massachusetts.
- CADWALDER, Major GOUVERNEUR, Manufacturer, O. O. R. C., Fort Washington, Pennsylvania.
- CAIRD, JAMES M., Chemist and Bacteriologist, Proctor's Building, 92 Fourth Street, Troy, New York.
- CALKINS, G. H., Manager, General Electric Company, Tenth Floor, Electric Building, Buffalo, New York.
- CALVERT, HAROLD, Electrical Engineer, President, Baird-Osterhout Company, 2114 Sansom Street, Philadelphia, Pennsylvania.
- CAMERON, Dr. FRANK K., Consulting Chemist, 46 Bransford Apartments, Salt Lake City, Utah.
- CANBY, WILLIAM W., Fruit Grower, Grants Pass, Oregon.
- CANFIELD, FREDERICK A., Mining Engineer, Dover, New Jersey.
- CAPLES, MARTIN J., Vice President, Seaboard Airline Railway Company, and for mail, 701 Stockley Gardens, Norfolk, Virginia.
- CAPP, JOHN A., Mechanical Engineer, 62 Bedford Road, Schenectady, New York.
- CAPP, S. BUNKER, Capitalist, P. O. Box 2054, Philadelphia, Pennsylvania.
- CAPPS, W. L., Rear Admiral, U. S. N., Chief Constructor, Bureau of Construction and Repair, Navy Department, Washington, D. C.
- CARTER, EDWARD C., Consulting Engineer, 412 Greenwood Boulevard, Evanston, Illinois.
- CARTY, Brig. General JOHN J., Vice President and Chief Engineer, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
- CASACOF, CHRISTO, Mechanical Engineer, 104 West 79th Street, New York City, New York.
- CASPARI, Dr. CHARLES E., Professor of Chemistry, 2108 Locust Street, St. Louis, Missouri.
- CASSELMAN, WILLIAM S., Attorney-at-Law, Secretary, West Jersey Title and Guarantee Company, and for mail, 317 Penn Street, Camden, New Jersey.
- CATHERWOOD, WILSON, Merchant, 1708 Walnut Street, Philadelphia, Pennsylvania.
- CHAPFEE, E. LEON, Assistant Professor of Physics, Croft Laboratory, Cambridge, Massachusetts.
- CHAMBERLAIN, G. E., Engineer, 1650 East William Street, Decatur, Illinois.
- CHAMBERS, Dr. ARTHUR DOUGLAS, Chemical Engineer, E. I. du Pont de Nemours and Company, and for mail, R. F. D. 1, Edgemoor, Delaware.
- CHAMBERS, FRANCIS T., Attorney-at-Law, 605-608 New Stock Exchange Building, 1411 Walnut Street, Philadelphia, Pennsylvania.
- CHAMBERS, J. HOWARD, Chambers Brothers Company, Founders and Machinists, and for mail, 52nd and Media Streets, Philadelphia, Pennsylvania.
- CHANCE, Dr. EDWIN M., Consulting Chemist and Engineer, 105 Sacramento Street, Atlantic City, New Jersey.

- CHANCE, Dr. HENRY M.**, Mining Engineer and Geologist, 839 Drexel Building, Philadelphia, Pennsylvania.
- CHANDLER, CHARLES F.**, Emeritus Professor of Chemistry, Columbia University, New York City, New York.
- CHANDLER, T. P.**, Architect, address unknown.
- CHARLTON, RICHARD C.**, 5017 Franklin Street, Frankfort, Philadelphia, Pennsylvania.
- CHESTERMAN, FRANCIS J.**, Chief Engineer, The Bell Telephone Company, 261 North Broad Street, Philadelphia, Pennsylvania.
- CHRISMAN, CHAS. S.**, Mechanical Engineer, The United Gas Improvement Company, 435 West Miner Street, West Chester, Pennsylvania.
- CHRISTIANSON, A.**, Chief Engineer, Standard Steel Car Company, and for mail, P. O. Box 877 Butler, Pennsylvania.
- CHURCH, ARTHUR L.**, Assistant to the President, The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- CLAGHORN, CLARENCE R.**, Mining Engineer, 715 Continental Building, Baltimore, Maryland.
- CLAMER, F. J.** (Retired), Collegeville, Montgomery County, Pennsylvania.
- CLAMER, G. H.**, Metallurgist and Chemist, First Vice President and Secretary, The Ajax Metal Company, Frankford Avenue and Richmond Street, Philadelphia, Pennsylvania.
- CLARK A. WAYNE**, Chemist, in care of Johnson and Johnson, New Brunswick, New Jersey.
- CLARK, BEAUVAIS**, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, Miss DARTHELA**, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, EDWARD B.**, Lieut.-Colonel, Publisher, 61 Cedar Street, Chicago, Illinois.
- CLARK, EDWARD L.**, Chief Engineer, Commercial Truck Company, Hunting Park and Rising Sun Avenues, Philadelphia, Pennsylvania.
- CLARK, E. W.**, Banker, 321 Chestnut Street, Philadelphia, Pennsylvania.
- CLARK, FRANK H.**, Consulting Engineer and Technical Advisor, Tuscany Apartments, 40th and Stony Run Roads, Baltimore, Maryland.
- CLARK, FRANK SHAW**, Mechanical Engineer, Stone and Webster Engineering Corporation, 147 Milk Street, Boston, Massachusetts.
- CLARK, JOSEPH S.**, Attorney-at-Law, Highland Avenue, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, THEOBALD F.**, 2300 Pine Street, Philadelphia, Pennsylvania.
- CLARK, WALTON**, Consulting Engineer, The United Gas Improvement Company, and for mail, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, Mrs. WALTON**, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, WALTON, Jr.**, Attorney-at-Law, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLOUD, JOHN W.**, Chairman, The Westinghouse Brake and Saxby Signal Company, Limited, 82 York Road, King's Cross, London, N. I. England.
- CLYMER, EVAN MORGAN**, Chief Clerk, Inspector of Hull Material for U. S. Navy, and for mail, 142 East Fishers Avenue, Olney, Philadelphia, Pennsylvania.
- COATFS, JESSE**, Consulting Engineer, and Metallurgist, 40 Ocean Avenue, Lynn, Massachusetts.
- COCHRAN, C. B.**, Chemist, State Dairy and Food Commission, and for mail, 514 South High Street, West Chester, Pennsylvania.
- COCKERILL, H. W.**, Technical Clerk, 19 Rata Road, Hataitai, Wellington, New Zealand.
- COES, HAROLD V.**, Industrial Engineer, 5901 Wayne Avenue, Germantown, Philadelphia, Pennsylvania.
- COFFIN, C. A.**, Chairman of the Board, General Electric Company, 120 Broadway, New York City, New York.
- COLBY, ALBERT LADD**, Consulting Engineer, 447 Brighton Street, Bethlehem, Pennsylvania.
- COLE, FRANCIS J.**, Chief Consulting Engineer, American Locomotive Company, and for mail, 640 South Hill Avenue, P. O. Box 459, Pasadena, California.
- COLLINGWOOD, J. REED**, Buyer, Fels and Company, and for mail, 510 South 41st Street, Philadelphia, Pennsylvania.
- COLLINS, ARTHUR L.**, Test Engineer, Abington, Pennsylvania.
- COLLINS, CHARLES RUSSELL**, Consulting Engineer, 805 Lowman Building, Seattle, Washington.
- COLLINS, HENRY H.**, Manufacturer, 226 Columbia Avenue, Philadelphia, Pennsylvania.
- COLLOM, SAMUEL H.**, President, Pennsylvania Flexible Metallic Tubing Company, 505 Abbott Building, Philadelphia, Pennsylvania.
- COLTON, SABIN W., JR.** (Retired), Banker, Bryn Mawr, Pennsylvania.
- COLVIN, CHARLES H.**, Mechanical Engineer, 61 Poplar Street, Brooklyn, New York.
- COLVIN, FRED H.**, Editor and Mechanical Engineer, 56 North Maple Avenue, East Orange, New Jersey.
- COLVIN, HENRY FRED, 2nd**, Student, 56 North Maple Avenue, East Orange, New Jersey.

- COLWELL, ROBERT C., Professor of Physics, Geneva College, and for mail, 3101 College Avenue, Beaver Falls, Pennsylvania.
- COMER, HARRIS, Chemist, Manufacturer of Scientific Apparatus, 622 South Washington Square, Philadelphia, Pennsylvania, and for mail, 431 State Road, Cynwyd, Pennsylvania.
- COMEY, Dr. ARTHUR M., Chemist, 380 Mt. Auburn St., Cambridge, Massachusetts.
- CONAWAY, JOHN F., Secretary and Treasurer, National Umbrella Frame Company, 30th and Thompson Streets, Philadelphia, Pennsylvania.
- CONDUCT, G. H., Consulting Mechanical and Electrical Engineer, 922 Central Avenue, Plainfield, New Jersey.
- CONN, CHARLES F., President, Giant Portland Cement Company, Pennsylvania Building, Philadelphia, Pennsylvania.
- CONNABLE, FRANK L., Vice President, E. I. du Pont de Nemours and Company, 622 du Pont Building, Wilmington, Delaware.
- CONVERSE, WILLIAM A., Chemical Engineer, Dearborn Chemical Company, McCormick Building, Chicago, Illinois.
- COOKE, MORRIS LLEWELLYN, Consulting Engineer in Management, Acting Director, The Utilities Bureau, 1009 Finance Building, and for mail, 401 West Walnut Lane, Germantown, Philadelphia, Pennsylvania.
- COOLEY, MORTIMER E., Dean, Colleges of Engineering and Architecture, Engineering Building, University of Michigan, Ann Arbor, Michigan.
- COOPER, HENRY, Manufacturer of Olive Oil, 403 East Valerio Street, Santa Barbara, California.
- COPE, THOMAS D., Assistant Professor of Physics, Randal Morgan Laboratory of Physics, University of Pennsylvania, Philadelphia, Pennsylvania.
- COPPAGE, BENJAMIN DENVER, Production Engineer, Levgor Structural Company, New York City, and for mail, 2402 Willard Street, Wilmington, Delaware.
- COPPAGE, G. L., Assistant Works Manager, The Pusey and Jones Company, Wilmington, Delaware.
- CORNELIUS, CLARENCE E., Salesman, 162 West Coulter Street, Germantown, Philadelphia.
- CORNELIUS, JOHN C., Jr., Architect, 420 West Price Street, Germantown, Philadelphia, Pennsylvania.
- CORNELIUS, JUSTICE C., Civil Engineer, 821 Lehigh Street, Easton, Pennsylvania.
- COSTER, EDWARD L., Literary Mechanical Engineer, Katonah, New York.
- COTTRELL, JAMES W., Dealer in Automobiles, P. O. Box 302, Hammonton, New Jersey.
- COWAN, HENRY B., District Engineer, 502 North 39th Street, Philadelphia, Pennsylvania.
- COWAN, WILLIAM ARTHUR, Assistant Chief Chemist, National Lead Company, 129 York Street, Brooklyn, New York.
- COWLES, ALFRED H., President, Electric Smelting and Aluminum Company, Sewaren, New Jersey.
- COX, J. D., President, Cleveland Twist Drill Company, Cleveland, Ohio.
- COX, JOHN L., Mechanical Engineer, 12 Summit Street, Chestnut Hill, Philadelphia, Pennsylvania.
- COX, WALTER, President, Pennsylvania Wire Glass Company, Pennsylvania Building, Philadelphia, Pennsylvania.
- COXE, ALEXANDER BROWN, Agriculturist, Paoli, Pennsylvania.
- CRAGO, WILLIAM H., Civil Engineer, in care of Fajardo Sugar Company, Fajardo, Porto Rico.
- CRAMP, FRANCIS L., Assistant to President, Wm. Cramp & Sons, Ship and Engine Building Company, Philadelphia, Pennsylvania.
- CRAMP, THEODORE W., Ship Builder, 816 Commercial Trust Building, Philadelphia, Pennsylvania.
- CRAMPTON, GEORGE S., Physician, 1819 Walnut Street, Philadelphia, Pennsylvania.
- CRAWFORD, D. F., General Manager, Pennsylvania Lines West of Pittsburgh, 5243 Ellsworth Avenue, Pittsburgh, Pennsylvania.
- CREIGHTON, H. JERMAIN, Assistant Professor of Chemistry, Swarthmore College, Swarthmore, Pennsylvania.
- CRENSHAW, Dr. JAMES L., Professor of Physical Chemistry, Bryn Mawr, Pennsylvania.
- CRISFIELD, J. A. P., Mechanical Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- CROASDALE, JOHN P., Attorney-at-Law, 1011 Chestnut Street, Philadelphia, Pennsylvania.
- CROOK, ALFRED, Vice President and General Manager, Philadelphia Roll and Machine Company, 25th Street and Washington Avenue, Philadelphia, Pennsylvania.
- CROSMAN, J. HERON, JR., Assistant Vice-president, The Bell Telephone Company of Pennsylvania, 1631 Arch Street, Philadelphia, Pennsylvania.
- CROWELL, WALTER S., Chemical Engineer, Oak Lane, Philadelphia, Pennsylvania.
- CULLEN, GEORGE S., Insurance, 4504 Springfield Avenue, Philadelphia, Pennsylvania.
- CUMMINGS, J. H., President, John B. Stetson Company, Philadelphia, Pennsylvania.
- CUNNINGHAM, J. L., Superintendent of Motive Power, Pennsylvania Railroad Company, Pittsburgh, Pennsylvania.

- CURRAN, G. W.**, Secretary, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- CURTIS, CYRUS H. K.**, Curtis Publishing Building, Philadelphia, Pennsylvania.
- CURTISS, ELLIOTT**, President and Treasurer, The United States Metallic Packing Company, 429 North 13th Street, Philadelphia, Pennsylvania.
- CURWEN, SAMUEL M.**, President, J. G. Brill Company, and for mail, Haverford, Pennsylvania.
- CUSHMAN, Dr. ALLERTON S.**, Director, The Institute of Industrial Research, 1845 B Street, N. W., Washington, D. C.
- DACOSTA, J. CHALMERS**, 3rd, Mechanical Engineer, Phoenix Mutual Life Insurance Company, 603 Finance Building, Philadelphia, Pennsylvania.
- DAILY, FRANCIS X.**, Engineer, The Bell Telephone Company of Pennsylvania, and for mail, 109 St. Pauls Road, Ardmore, Pennsylvania.
- DANNENBAUM, HERMAN N.**, Manufacturer, Vice President, National Ammonia Company, 109 St. Pauls Road, Frankford, Philadelphia, Pennsylvania.
- DASHIELL, BENJ. J.**, Consulting Engineer, Dunkirk P. O. Calvert County, Maryland.
- DASHIELL, P. T.**, Assistant Engineer of Works, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- DAVIDS, R. W.**, Consulting Electrical Engineer, Merion Station, Pennsylvania.
- DAVIDSON, GEORGE M.**, Chemist and Engineer of Tests, C. & N. W. R. R. Company, Chicago, Illinois.
- DAVIS, CARLETON E.**, Civil Engineer, 113 Monument Circle, Indianapolis, Indiana.
- DAVIS, CHARLES HENRY**, President and Trustee, Bass River, Cape Cod, Massachusetts.
- DAVIS, ERNEST H.**, Manager of Street Railways and Electric Light Plants, P. O. Box 424, Williamsport, Pennsylvania.
- DAWES, JAMES H.**, General Contractor, 1310 Arch Street, Philadelphia, Pennsylvania.
- DAY, Dr. ARTHUR L.**, Director Geophysical Laboratory, Carnegie Institution, Washington, D. C.
- DAY, CHARLES**, Member of Firm, Day and Zimmermann, Engineers, 1600 Walnut Street, Philadelphia, Pennsylvania.
- DAY, DAVID T.**, Petroleum Expert, 715 19th Street, N. W., Washington, D. C.
- DAY, R. H.**, Steel Manufacturer, 505 W. Clapier Street, Philadelphia, Pennsylvania.
- DE GRAAFF, ANTONIUS**, Chemical Engineer, Philips' Glowlampworks, Ltd., Eindhoven, Holland.
- DELANO, FREDERIC A.**, Receiver, 288 Treasury Building, Washington, D. C.
- DELANY, PATRICK B.**, Electrical Engineer, South Orange, New Jersey.
- DELBRIDGE, THOMAS D.**, Chemist, Atlantic Refining Company, 3144 Passyunk Avenue, Philadelphia, Pennsylvania.
- DELLENBAUGH, FREDERICK S., JR.**, Electrical Engineer, Massachusetts Institute of Technology, and for mail, 91 Spooner Road, Chestnut Hill, Massachusetts.
- DEMPSEY, W. L.**, Engineer and Attorney-at-Law, 618 Perry Building, Philadelphia, Pennsylvania.
- DENIG, FRED.**, Combustion Engineer, The Koppers Company, Union Arcade, Pittsburgh, Pennsylvania.
- DESHONG, HOWARD T.**, Superintendent, Philadelphia Electric Company, and for mail, 9 Lansdowne Avenue, Lansdowne, Pennsylvania.
- DETWILER, J. G.**, Chemist, Room 913, The Texas Company, Houston, Texas.
- DICKERSON, EDWARD N.**, Attorney-at-Law, 41 Park Row, New York City, New York.
- DIDIER, PAUL**, Principal Assistant Engineer, Baltimore and Ohio Railroad Company, Conestoga Building, Wood and Water Streets, Pittsburgh, Pennsylvania.
- D'INVILLIERS, EDWARD VINCENT**, Geologist and Mining Engineer, 518 Walnut Street, Philadelphia, Pennsylvania.
- DISSTON, WILLIAM D.**, Manufacturer, in care of Henry Disston & Sons, Tacony, Philadelphia, Pennsylvania.
- DIVEN, J. M.**, Secretary, American Water Works Association, 153 West 71st Street, New York City, New York.
- DOANE, SAMUEL E.**, Chief Engineer National Lamp Works of the General Electric Company, Nela Park, Cleveland, Ohio.
- DODGE, KERN**, Consulting Engineer, Morris Building, Philadelphia, Pennsylvania.
- DOHERTY, HENRY L.**, President, Cities Service Company, 60 Wall Street, New York City, New York.
- DOLAN, THOMAS J.**, Chestnutwold Farm, Devon, Pennsylvania.
- DONALD, JAMES**, Naval Architect, Liverpool, England.
- DONALD, WILLIAM**, Chemist and Assayer, Bloomingdale, New Jersey.
- DONOHUE, JOHN P.**, Coal Operator, Coulter Building, Greensburg, Pennsylvania.
- DORNER, WILLIAM F.**, 25th Ward Gas Works, Richmond and Tioga Streets, Philadelphia, Pennsylvania.
- DORR, JOHN V. N.**, Metallurgical and Chemical Engineer, President, The Dorr Company, Westport, Connecticut.

- DOUREDOURE, BERNARD L., Student, 103 Walnut Street, Philadelphia, Pennsylvania.
- DOUTHIRT, WALSTEIN F., 1752 Equitable Building, New York City, N. Y.
- DOW, HERBERT H., General Manager, The Dow Chemical Company, Midland, Michigan.
- DOYLE, WILLIAM J., Contractor and Builder, 1519 Sansom Street, Philadelphia, Pennsylvania.
- DRAKE, LEWIS MARVIN, Experimental Scientist, West Fairview Avenue, Daytona, Florida.
- DREXEL, JOHN R., 112 Drexel Building, Philadelphia, Pennsylvania.
- DUBOSQUE, F. L., Superintendent of Floating Equipment, Pennsylvania Station, New York City, New York.
- DUNCAN, J. S., Inventor, 901 West Van Buren Street, Chicago, Illinois.
- DUNCAN, THOMAS, President, Duncan Electric Manufacturing Company, Lafayette, Indiana.
- DUNDORE, CHARLES R., 8205 Seminole Avenue, Philadelphia, Pennsylvania.
- DUNN, GANO, President, J. G. White Engineering Corporation, and for mail, 20 Washington Square, New York City, New York.
- DUNNINGTON, F. P., Professor of Chemistry, University of Virginia, Virginia.
- DUPONT, COLEMAN, 808 Broome Street, Wilmington, Delaware.
- DUPONT, IRENEE, Vice President, E. I. du Pont de Nemours and Company, Wilmington, Delaware.
- DUPONT, PIERRE S., President, E. I. du Pont de Nemours and Company, Wilmington, Delaware.
- DURBAN, THOMAS E., General Manager, Erie City Iron Works, Erie, Pennsylvania.
- D'UTASSY, GEO., Publisher, Cedarhurst, Long Island, New York.
- EARNSHAW, WARNER G., Harrison Building, Philadelphia, Pennsylvania.
- EASON, JOHN STUART, Manufacturer and Industrial Engineer, 740 58th Street, Milwaukee, Wisconsin.
- EATON, ROLAND L., 20 South Eighteenth Street, Philadelphia, Pennsylvania.
- EAVENSON, HOWARD N., Engineer, 4311 Bayard Street, Pittsburgh, Pennsylvania.
- EBERLE, E. G., Editor, Journal of the American Pharmaceutical Association, Room 253, Bourse Building, Philadelphia, Pennsylvania.
- ECKERT, SAMUEL B., Oil Refiner, Finance Building, 1428 South Penn Square, Philadelphia, Pennsylvania.
- ECKHARDT, E. A., Physicist, Bureau of Standards, Washington, D. C.
- EDGAR, C. L., President and General Manager, Edison Electric Illuminating Company, 70 State Street, Boston, Massachusetts.
- EDISON, THOMAS A., Inventor, Orange, New Jersey.
- EGLIN, W. C. L., Vice President and Chief Engineer, Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- EGLOFF, DR. GUSTAV, Petroleum Technologist, 344 South Hamline Avenue, Chicago, Illinois.
- EHRENFELD, DR. FREDERICK, College Hall, University of Pennsylvania, Philadelphia, Pennsylvania.
- EHRET, CORNELIUS D., Patent Lawyer, 6911 Clearview Street, Mount Airy, Philadelphia, Pennsylvania.
- ELDRED, DR. BYRON E., 41 East 42nd Street, New York City, New York.
- ELKINS, GEORGE W., Vice President of Companies, Land Title Building, Philadelphia, Pennsylvania.
- ELKINTON, HOWARD W., Assistant Manager, Foreign Department, Philadelphia Quartz Company, 121 South Third Street, Philadelphia, Pennsylvania.
- ELKINTON, THOMAS W., Philadelphia Quartz Company, 121 South Third Street, Philadelphia, Pennsylvania.
- ELLIOT, EDWIN, Foundry Superintendent, 403 West Price Street, Germantown, Philadelphia, Pennsylvania.
- ELLIS, CARLETON, Research Chemist and Chemical Engineer, 92 Greenwood Avenue, Montclair, New Jersey.
- ELLIS, HALCOLM, Mechanical Engineer, Fabrique Nationale d'Armes de Guerre, Herstal-les Liege, Belgium.
- ELMENDORF, ARMIN, Consulting Engineer, Vickers House, Broadway, Westminster, London, S. W. 1, England.
- ELVERSON, JAMES, JR., Publisher, The Philadelphia Inquirer, Philadelphia, Pennsylvania.
- EMERICK, J. M., Office Manager, 1501 Commonwealth Building, Philadelphia, Pennsylvania.
- EMERSON, GEORGE H., Chief of Motive Power and Equipment, Baltimore and Ohio Railroad, Baltimore, Maryland.
- EMERSON, HARRINGTON, Efficiency Engineer, Room 1522, Hudson Terminal Building, 30 Church Street, New York City, New York.
- EMERY, A. H., Civil and Mechanical Engineer, Glenbrook, Connecticut.
- ENGELHARD, CHARLES, Importer, Hudson Terminal Building, 30 Church Street, New York City, New York.
- EPPELSHEIMER, DANIEL, JR., Chief Engineer, 419 Broadway, Middletown, Ohio.
- ERHART, WILLIAM H., Manufacturing Chemist, 81 Maiden Lane, New York City, New York.

- ERNE, ALFRED, Clerk, William H. Horstmann Company, 5217 Delancey Street, Philadelphia, Pennsylvania.
- ETTINGER, R. L., Consulting Mechanical Engineer, Southern Railway, 1300 Pennsylvania Avenue, Washington, D. C.
- EVANS, OWEN BROOKE, Mechanical Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- EVANS, POWELL, 2035 Washington Avenue, Philadelphia, Pennsylvania.
- EVANS, WAYNE S., Manufacturer of Metal Goods, 4623 Paul Street, Frankford, Philadelphia, Pennsylvania.
- EVE, A. S., Professor of Physics, McGill University, Montreal, Canada.
- EYANSON, J. EDWARD, 207 South 10th Street, Philadelphia, Pennsylvania.
- FABRY, CHARLES, Professor of Physics, University of Paris, 1 Rue Victor-Cousin, Paris (5e) France.
- FAHRIG, ERNEST, Mining Engineer, Appalachian Range, North Carolina.
- FAIRCHILD, S. E., JR., Civil and Mining Engineer, Land Title Building, Philadelphia, Pennsylvania.
- FALKENAU, ARTHUR, Industrial Engineer, 911 Park Avenue, New York City, New York.
- FARRAND, DUDLEY, Assistant to the President, Public Service Corporation of New Jersey, 80 Park Place, Newark, New Jersey.
- FAUGHT, Dr. L. ASHLEY, Professor of Operative Dentistry, Philadelphia Dental College, Temple University, and for mail, Medical Arts Building, Philadelphia, Pennsylvania.
- FEARING, FREDERICK C., Consulting Engineer, 2112 Delancey Place, Philadelphia, Pennsylvania.
- FEARON, CHARLES, Banker, 333 Chestnut Street, Philadelphia, Pennsylvania.
- FEBIGER, C. C., 3421 Powelton Avenue, Philadelphia, Pennsylvania.
- FELLOWS, E. R., President and General Manager, The Fellows Gear Shaper Company, Springfield, Vermont.
- FELS, MAURICE, 4305 Spruce Street, Philadelphia, Pennsylvania.
- FELS, SAMUEL S., Soap Manufacturer, 39th and Walnut Streets, Philadelphia, Pennsylvania.
- FELTON, EDGAR CONWAY, President, Pennsylvania Steel Company, and for mail, Haverford, Pennsylvania.
- FELTON, SAMUEL M., President, Chicago Great Western Railway, 1121 Peoples Gas Building, Chicago, Illinois.
- FERGUSON, LOUIS A., Vice President and Electrical Engineer, Commonwealth Edison Company, Box 767, 72 West Adams Street, Chicago, Illinois.
- FERGUSON, WALTER B., 426 School Lane, Germantown, Philadelphia, Pennsylvania.
- FERNALD, ROBERT HEYWOOD, Whitney Professor of Dynamical Engineering, Mechanical Engineering Department, University of Pennsylvania, Philadelphia, Pennsylvania.
- FERNANDEZ, GUY D., Electrical Engineer, Haddon Heights, New Jersey.
- FERREE, Dr. C. E., Teacher, Bryn Mawr College, Bryn Mawr, Pennsylvania.
- FERRIE, GENERAL G., Inspecteur des Services de la Telegraphie Militaire et des Transmissions, 51 Bis, Boulevard LaTour-Maubourg, Paris, France.
- FINCH, W. G. H., Radio Editor and Engineer, International News Company, 21 Spruce Street, New York City, New York.
- FINKBINER, E. W., Representative, E. F. Houghton Company, and for mail, 207 Market Street, Newark, New Jersey.
- FINLEY, W. H., President C. & N. W. Railway Company, and for mail, 412 N. Washington Street, Wheaton, Illinois.
- FISHER, E. C., Vice President and General Manager, The Wilkes Boiler Company, and for mail, 308 North Jefferson Avenue, Saginaw, Michigan.
- FISHER, THOMAS, General Manager, Berwind White Coal Mining Company, 1100 Commercial Trust Building, Philadelphia, Pennsylvania.
- FITTS, JAMES LOGAN, Mechanical Engineer, in care of Warren Webster and Company, Point and Pearl Streets, Camden, New Jersey.
- FITZ, E. M., Electrical Engineer, Room 611, New First National Bank Building, Columbus, Ohio.
- FITZGERALD, FRANCIS A. J., Consulting Engineer and President, The Fitzgerald Laboratories, Niagara Falls, New York.
- FITZMAURICE, WILLIAM J., JR., Civil Engineer, 747 Marlyn Road, Philadelphia, Pennsylvania.
- FLANAGAN, CHARLES L., Insurance, Riverton, New Jersey.
- FLANAGAN, LOUIS A., Riverton, New Jersey.
- FLANDERS, RALPH E., Manager, Jones and Lamson Machine Company, and for mail, 41 Pleasant Street, Springfield, Vermont.
- FLEISHER, B. W., Manufacturer, 2301 Green Street, Philadelphia, Pennsylvania.
- FLEMING, FRANCIS P., Attorney-at-Law, 301 Heard Building, Jacksonville, Florida.
- FLETCHER, W. E., Technical Director, Atlas Powder Company, Wilmington, Delaware, and for mail, 4609 Osage Avenue, Philadelphia, Pennsylvania.
- FOOTE, ARTHUR DE WINT, Civil Engineer, North Star Mines, Grass Valley, California.

- FORBES, GEORGE**, Professor of Electrical Engineering, No. 11 Little College Street, Westminster, S. W., London, England.
- FORD, BRUCE**, Vice President, Electric Storage Battery Company, and for mail, 25 Summit Street, Chestnut Hill, Philadelphia, Pennsylvania.
- FORD, TERENCE J.**, Assistant Inspector of Ordnance U. S. Navy, and for mail, 847 E. Fourth Street, Bethlehem, Pennsylvania.
- FORREST, CHARLES N.**, Manager, Technical Department, Barber Asphalt Paving Company, Maurer, New Jersey.
- FORSTALL, WALTON**, Gas Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- FOSTER, CHARLES E.**, Lawyer and Mechanical Expert, 120 St. George's Road, Ardmore, Pennsylvania.
- FRANCIS, ISAAC H.**, Consulting Mechanical and Electrical Engineer, Otis Building, Philadelphia, Pennsylvania.
- FRANK, EDWIN**, Mechanical Engineer, 1015 Shepard Avenue, Milwaukee, Wisconsin.
- FRANKLIN, BENJAMIN**, Civil and Consulting Engineer, 906-7 Crozer Building, Philadelphia, Pennsylvania.
- FRAZER, PERSIFOR, JR.**, Shipbuilder, Merchant Shipbuilding Company, Estey Building, Philadelphia, Pennsylvania.
- FRAZIER, GEORGE H.**, Banker, P. O. Box 1630, Philadelphia, Pennsylvania.
- FRAZIER, W. W., Jr.**, Sugar Refiner, Lock Box 1630, Philadelphia, Pennsylvania.
- FREEMAN, HAROLD A.**, (Retired), St. Davids, Pennsylvania.
- FREEMAN, W. W.**, President, The Union Gas and Electric Company, 4th and Plum Streets, Cincinnati, Ohio.
- FRENCH, HOWARD B.**, Manufacturer, 410 Callowhill Street, Philadelphia, Pennsylvania.
- FRERICHS, Dr. F. W.**, Vice President, Herf and Frerichs Chemical Company, St. Louis, Missouri.
- FRETZ, E. S.**, Manufacturer, The Light Manufacturing and Foundry Company, Pottstown, Pennsylvania.
- FRIES, HAROLD H.**, Manufacturing Chemist, 92 Reade Street, New York City, New York.
- FRY, ANN W.**, 6432 Jefferson Street, Germantown, Philadelphia, Pennsylvania.
- FRYER, GEORGE G.**, Mechanical Engineer, 203 Onondaga Avenue, Syracuse, New York.
- FUGUET, HOWARD**, 560 Bullitt Building, 121-141 South Fourth Street, Philadelphia, Pennsylvania.
- FULLER, GEORGE W.**, Consulting Engineer, 170 Broadway, New York City, New York.
- FULWEILER, W. H.**, Engineer, United Gas Improvement Company, 319 Arch Street, Philadelphia, Pennsylvania.
- FUNK, N. E.**, Electrical Engineer, 930 Wynnewood Road, Philadelphia, Pennsylvania.
- FURNESS, GEORGE W.**, Millville, New Jersey.
- FURNESS, HORACE HOWARD, JR.**, Writer, 701 Stephen Girard Building, Philadelphia, Pennsylvania.
- FURNESS, RADCLYFFE**, Engineer of Research, Midvale Steel Company, P. O. Box 1606, Philadelphia, Pennsylvania.
- GAGE, Dr. HENRY PHELPS**, Physicist, Chief, Optical Division, Corning Glass Works, and for mail, 212 Chemung Street, Corning, New York.
- GALLOWAY, C. D.**, Mechanical Engineer, Electric Storage Battery Company, and for mail, 8409 Anderson Street, Chestnut Hill, Philadelphia, Pennsylvania.
- GARDNER, HENRY A.**, Chemical Engineer, Assistant Director, Institute of Industrial Research, Washington, D. C.
- GARMAN, FRANK R.**, Engineering Assistant, Bell Telephone Company, 1714 Tioga Street, Philadelphia, Pennsylvania.
- GARRELS, W. L.**, Consulting Engineer, (Kirkwood Route 13) Mason and Manchester Roads, St. Louis County, Missouri.
- GARRIGUES, F. H.**, Life Insurance, 6806 N. Eleventh Street, Philadelphia, Pennsylvania.
- GARRISON, F. LYNWOOD**, Mining Engineer, 1019 Clinton Street, Philadelphia, Pennsylvania.
- GARTLEY, WILLIAM H.**, Gas Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- GAZZAM, JOSEPH M.**, Retired Lawyer, 265 South 19th Street, Philadelphia, Pennsylvania.
- GESELL, W. H.**, Chemical Engineer and Manager, Lehn and Fink, Incorporated, Bloomfield, New Jersey, and for mail, 235 Christopher Street, Montclair, New Jersey.
- GEST, WILLIAM P.**, President, Fidelity Trust Company, 327 Chestnut Street, Philadelphia, Pennsylvania.
- GETMAN, Dr. FREDERICK H.**, Chemist, Hillside Laboratory, Stamford, Connecticut.
- GFRORER, A. H.**, Engineer, The Automatic Transportation Company, 2933-65 Main Street, Buffalo, New York.
- GHERARDI, BANCROFT**, Engineer of Plant, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
- GIBBS, A. E.**, Chemist Pennsylvania Salt Manufacturing Company, Widener Building, Philadelphia, Pennsylvania.
- GIBBS, E. L.**, Inspector, Interstate Commerce Commission, and for mail, 2004 Herschell Street, Jacksonville, Florida.
- GIBBS, WEBB L.**, Lubricating Engineer, 7734 South Shore Drive, Chicago, Illinois.

- GIBSON, J. J., District Manager, Westinghouse Electric and Manufacturing Company, 165 Broadway, New York City, New York.
- GILBRETH, FRANK E., Consulting Engineer, 68 Eagle Rock Way, Montclair, New Jersey.
- GILCHRIST, JOHN F., Vice President, Commonwealth Edison Company, Edison Building, Chicago, Illinois.
- GILL, JOHN D., Chemical Engineer, Atlantic Refining Company, 3144 Passyunk Avenue, Philadelphia, Pennsylvania.
- GILPIN, FRANCIS H., Gas Engineer, 22 Edgemont Avenue, Summit, New Jersey.
- GITTLESON, FRANK, Violinist, 3500 Holmes Avenue, Baltimore, Maryland.
- GLENDINNING, ROBERT E., Banker, 400 Chestnut Street, Philadelphia, Pennsylvania.
- GLOVER, HENRY, Manufacturer, 3123 Midvale Avenue, Philadelphia, Pennsylvania.
- GLOVER, ROLFE E., JR., Chemist, 2435 West 18th Street, Wilmington, Delaware.
- GOLDBAUM, JACOB, S., Research Chemist, 4234 Spruce Street, Philadelphia, Pennsylvania.
- GOLDSCHMIDT, V., Professor, Heidelberg University, and for mail, Gaisberg Strasse 9, Heidelberg, Germany.
- GOLDSMITH, EDWARD, Retired Chemist, 658 North 10th Street, Philadelphia, Pennsylvania.
- GOLDSMITH, EDWIN M., Manufacturer, Friedberger-Aaron Manufacturing Company, Logan Station, Philadelphia, Pennsylvania.
- GOMBERG, MOSES, Professor of Chemistry, 725 Oxford Road, Ann Arbor, Michigan.
- GOODSPEED, ARTHUR W., Professor of Physics, University of Pennsylvania, Philadelphia, Pennsylvania.
- GOODWIN, HAROLD, JR., Electrical Engineer, 3927 Locust Street, Philadelphia, Pennsylvania.
- GORDON, HUGH S., Mining Engineer, 10 Nevill Court, London, England.
- GRAFTON, E. H., Chief Chemist, Quaker City Rubber Company, Wissinoming, Philadelphia, Pennsylvania.
- GRAHAM, WALTER F., Metallurgist, Curtis Bay Copper and Iron Works, Curtis Bay, Baltimore, Maryland.
- GRAHAM, W. M., Bookkeeper, 30 South Rhode Island Avenue, Atlantic City, New Jersey.
- GRANBERY, J. H., Civil Engineer, American Can Company, Boston and Hudson Streets, Baltimore, Maryland.
- GRAVELL, J. H., President, American Chemical Paint Company, 1126 South Eleventh Street, Philadelphia, Pennsylvania.
- GREEN, GEORGE ROSS, Electrical Engineer, Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- GREENE, ARTHUR M., JR., Professor of Mechanical Engineering, Princeton University, Princeton, N. J.
- GREENE, JOSEPH F., Chemical Engineer, Kimble Glass Company, Vineland, New Jersey.
- GREENWOOD, RICHARD, Acting Superintendent, 1212 Allengrove Street, Frankford, Philadelphia, Pennsylvania.
- GREENWOOD, TALMA TEMPLE, Research Engineer and Patent Solicitor, 40 Court Street, Boston, Massachusetts, and for mail, East Templeton, Massachusetts.
- GRIBBEL, JOHN, Gas Meter Manufacturer, 1513 Race Street, Philadelphia, Pennsylvania.
- GRIBBEL, W. GRIFFIN, Gas Meter Manufacturer, 1513 Race Street, Philadelphia, Pennsylvania.
- GRIEST, Major THOMAS H., Civil Engineer, The Bell Telephone Company of Pennsylvania, 261 North Broad Street, Philadelphia, Pennsylvania.
- GRIFFIN, FRANK H., Chief Chemist, Viscose Company, Marcus Hook, Pennsylvania.
- GRIFFITH, WILLIAM, Mining Engineer and Geologist, Coal Exchange Building, Scranton, Pennsylvania.
- GRIFFITH, W. O., The Clearing, Saunderstown, Rhode Island.
- GRISSINGER, ELWOOD, Consulting Electrical and Mechanical Engineer, 293 Lexington Avenue, Buffalo, New York.
- GRISWOLD, ROBERT G., Director of Research, Henry L. Doherty & Company, 60 Wall Street, New York City, New York.
- GROSS, Dr. A. S., Dental Suregon, 508½ Main Street, Newton, Kansas.
- GUBELMAN, FREDERICK I., President, The Regina Company, and for mail, Woodland Ave., Englewood, New Jersey.
- GUCKER, F. T., Civil Engineer and Contractor, 1450 Real Estate Trust Building, Philadelphia, Pennsylvania.
- GUDEMAN, Dr. EDWARD, Consulting Scientific Expert, 903 Postal Telegraph Building, Chicago, Illinois.
- GUTHRIE, BAYARD, R. F. D. No. 2, Ocean Springs, Mississippi.
- HAGAR, WALTER F., JR., Manufacturer, The Hagar Company, Ambler, Pennsylvania.
- HAHN, C. V., Lieutenant, U. S. A. Ordnance Department, P. O. Box 4039, Philadelphia, Pennsylvania.
- HAIGIS, CARLETON D., Research Physicist, Victor Talking Machine Company, Camden, New Jersey.
- HAINES, CASPTER WISTAR, Civil Engineer, 6026 Germantown Avenue, Philadelphia, Pennsylvania.

- HAINES, ROBERT B., JR.**, Manufacturer of Rolling Mill Gauges and Haines' Automatic Micrometer, 156 West School Lane, Germantown, Philadelphia, Pennsylvania.
- HAINES, WILLIAM A.**, Manufacturer of Fancy Leather Goods, 6445 Wissahickon Avenue, Philadelphia, Pennsylvania.
- HALE, HENRY S.**, Address unknown.
- HALL, C. A.**, Chemical Engineer, Cresheim Arms, Allen Lane, Philadelphia, Pennsylvania.
- HALL, R. T.**, Rear Admiral, U. S. N., P. O. Box 228, Wynnewood, Pa.
- HALSEY, WILLIAM B.**, Electrical Engineer, 27 Fairview Place, corner Church Avenue, Brooklyn, New York.
- HAMMER, EDWARD W.**, Consulting Engineer, 160 Broadway, New York City, New York.
- HAMMER, WILLIAM J.**, Consulting Electrical Engineer, Hotel Earle, 103 Waverly Place, New York City, New York.
- HAMMOND, J. M.**, 14 East Abington Avenue, Chestnut Hill, Philadelphia, Pennsylvania.
- HANTHORN, JOSEPH R.**, Mechanical Engineer, 4135 Girard Avenue, Philadelphia, Pennsylvania.
- HARDING, WILLIAM H.**, Cement Manufacturer, Mechanical and Electrical Engineer, 1127 Land Title Building, Philadelphia, Pennsylvania.
- HARRIS, FRANKLIN M.**, Brick Mason, Belle Claire Apartments, 40th Street and Parkside Avenue, Philadelphia, Pennsylvania.
- HARRISON, ALFRED C.**, Retired Sugar Refiner, 660 Drexel Building, Philadelphia, Pennsylvania.
- HARRISON, Dr. CHARLES C.**, (Retired), 400 Chestnut Street, Philadelphia, Pennsylvania.
- HARRISON, GEORGE L.**, (Retired), 1704 Locust Street, Philadelphia, Pennsylvania.
- HARRISON, J. K. M.**, Engineer, Harrison and Company, Drexel Building, Philadelphia, Pennsylvania.
- HARRISON, MITCHELL**, Financier, Nokesville, Virginia.
- HARRISON, WILLIAM W.**, Merchant, 119 North 11th Street, Philadelphia, Pennsylvania.
- HART, CHARLES**, President, Delaware River Steel Company, Chester, Pennsylvania.
- HART, EDWARD**, Professor of Chemistry, Lafayette College, Easton, Pennsylvania.
- HARTNESS, JAMES**, President, Jones and Lamson Machine Company, and for mail, 30 Orchard Street, Springfield, Vermont.
- HARTUNG, ADOLPH**, Paper Merchant, 506 Race Street, Philadelphia, Pennsylvania.
- HARTZEL, FRANCIS W.**, Carburetted Water Gas Manufacturer, 7039 Rising Sun Avenue, Philadelphia, Pennsylvania.
- HARVEY, RICHARD P.**, Engineering Specialties, 336 Herman W. Hellman Building, Los Angeles, California.
- HASCHKA, FERD. T.**, Watchmaker, Tiffany and Company, and for mail, 135 West 78th Street, New York City, New York.
- HATTON, T. CHALKLEY**, Chief Engineer, Sewage Commission, City Hall, Milwaukee, Wisconsin.
- HAUPT, Professor LEWIS M.**, Consulting Engineer, Cynwyd, Pennsylvania.
- HAWKINS, J. DAWSON**, Metallurgist, Colorado Springs, Colorado.
- HAWKSWORTH, FRANKLIN G.**, Dentist, 314 North 13th Street, Philadelphia, Pennsylvania.
- HAYWARD, NATHAN**, President, American Dredging Company, Consulting Engineer, The Bell Telephone Company of Pennsylvania, 308 Chestnut Street, Philadelphia, Pennsylvania.
- HAZEL, ALLEN**, Consulting Civil Engineer, 23 West Forty-Third, Street, New York City, New York.
- HEILMAN, D. B.**, Safety Engineer, P. O. Box 453, Reading, Pennsylvania.
- HEITMANN, EDWARD**, Electrical Engineer, Fairmount Hotel, 2595 Boulevard, Jersey City, New Jersey.
- HELME, WILLIAM E.**, Manufacturer, 1339 Cherry Street, Philadelphia, Pennsylvania.
- HENSON, EDWARD FRANCIS**, Lumber Merchant, 921 North Delaware Avenue, Philadelphia, Pennsylvania.
- HEPBURN, Dr. JOSEPH SAMUEL**, Biological Chemist, Constantine Hering Laboratory, Hahnemann Medical College, 220 N. Broad Street, Philadelphia, Pennsylvania.
- HERING, Dr. CARL**, Consulting Electrical Engineer, 1317 Spruce Street, Philadelphia, Pennsylvania.
- HERING, WALTER E.**, President, The Globe Ticket Company, 112 North 12th Street, Philadelphia, Pennsylvania.
- HERR, EDWIN M.**, President, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., and for mail, 140 Hutchinson Avenue, Edgewood Park, Pennsylvania.
- HERRESHOFF, NATHANAEAL GREENE**, Naval Architect and Marine Engineer, Herreshoff Manufacturing Company, Bristol, Rhode Island.
- HERSAM, ERNEST A.**, Professor of Metallurgy, University of California, Berkeley, California.
- HERTY, Dr. CHARLES H.**, Chemist, 1 Madison Avenue, New York City, New York.
- HESS, WALTER C.**, Paint Manufacturer, 4635 Walnut Street, Philadelphia, Pennsylvania.

- HETZEL, FREDERIC V., Mechanical Engineer, P. O. Box 366, West Chester, Pennsylvania.
- HEXAMER, CHARLES A., Civil Engineer, Bullitt Building, Philadelphia, Pennsylvania.
- HICKS, THOMAS W., Manufacturer of Farm Implements, 4516 Fremont Avenue, South Minneapolis, Minnesota.
- HILL, JOHN W., Consulting Engineer, Rooms 45-46, Bodmann Building, 621 Main Street, Cincinnati, Ohio.
- HILL, ROY LINDEN, Chemist, Atlas Powder Company, Tamaqua, Pennsylvania.
- HIRES, CHARLES E., Manufacturing Chemist, 206 South 24th Street, Philadelphia, Pennsylvania.
- HITCHCOCK, Dr. FANNY R. M., 37 Maple Avenue, Warwick, New York.
- HITCHINS, ALFRED B., Research Chemist, in care of Ansco Company, Research Laboratory, Binghamton, New York.
- HOADLEY, ANTHONY DE H., Student, Union College, Schenectady, New York.
- HOADLEY, Professor GEORGE A., (Retired), Swarthmore, Pennsylvania.
- HOFSTETTER, GEORGE, Blank Book Maker, Lithographer, 247-53 South American Street, Philadelphia, Pennsylvania.
- HOLLAND, WALTER E., Research Engineer, Philadelphia Storage Battery Company, Ontario and C Streets, Philadelphia, Pennsylvania.
- HOLLANDER, CHARLES S., Chemist and Chemical Engineer, in care of Rohm and Haas Company, Bristol, Pennsylvania.
- HOLLISTER, S. C., Civil Engineer, Light, Hollister and Ferguson, Land Title Building, Philadelphia, Pennsylvania.
- HOLMES, GEORGE R., Technical Journalist, 135 Garrison Avenue, Jersey City, New Jersey.
- HOLST, L. J. R., Mechanical Engineer, Harvard Road, Brookline, Delaware County, Pennsylvania.
- HONAMAN, R. KARL, Electrical Engineer, Development and Research Department American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
- HOOKER, SAMUEL C., Chemist and Sugar Refiner, 82 Remsen Street, Brooklyn, New York.
- HORN, FRANKLIN S., Lunch Room Proprietor, 1515 Arch Street, Philadelphia, Pennsylvania.
- HORNSEY, JOHN W., Consulting Engineer, "The Oakes," Norton near Sheffield, England.
- HORSTMANN, W., President, Wm. H. Horstmann and Company, 5th and Cherry Streets, Philadelphia, Pennsylvania.
- HORTON, ROBERT E., Consulting Hydraulic Engineer, R. F. D. No. 1 Voorheesville, New York.
- HOSKINS, WILLIAM, Chemist, Room 2009, 11 West Monroe Street, Chicago, Illinois.
- HOUSTON, SAMUEL F., Trustee, 512 Real Estate Trust Building, Philadelphia, Pennsylvania.
- HOWARD, A. C., Gas Engineer, 61 Broadway, New York City, New York.
- HOWE, ARTHUR W., Broker, 1811 Walnut Street, Philadelphia, Pennsylvania.
- HOWELL, JOHN W., Engineer, Lamp Works, General Electric Company, Harrison, New Jersey.
- HOWER, Professor HARRY S., Physicist, Carnegie Institute of Technology, and for mail, 5709 Solway Street, Pittsburgh, Pennsylvania.
- HOWSON, CHARLES HENRY, Patent Solicitor and Engineer, 32 South Broad Street, Philadelphia, Pennsylvania.
- HOWSON, MISS EMILY E., Instructor in Physics, Agnes Scott College, Decatur, Georgia.
- HOWSON, HENRY, Patent Solicitor and Engineer, West End Trust Building, Philadelphia, Pennsylvania.
- HOWSON, RICHARD, 36 Mansion Avenue, Haddonfield, New Jersey.
- HUFF, ERNEST L., Electrical Engineer, Natrona, Pennsylvania.
- HUHN, GEORGE A., Banker, 1600 Walnut Street, Philadelphia, Pennsylvania.
- HUMPHREYS, ALEXANDER C., Consulting Engineer, President, Stevens Institute of Technology, Hoboken, New Jersey.
- HUMPHREYS, Dr. W. J., Physicist, Weather Bureau, Washington, D. C.
- HUSTON, CHARLES L., Vice President, Lukens Steel Company, Coatesville, Pennsylvania.
- HUTCHINSON, CARY T., Consulting Engineer, 65 West 54th Street, New York City, New York.
- HUTCHINSON, S. PEMBERTON, President, Westmoreland Coal Company, 224 South 3rd Street, Philadelphia, Pennsylvania.
- HUTTINGER, W. R., Mechanical Engineer, 86 East Greenwood Avenue, Lansdowne, Pennsylvania.
- HYDE, EDWARD P., Director, Nela Research Laboratory, Nela Park, Cleveland, Ohio.
- INDAHL MAURITZ C., Mechanical Engineer, 248 East Johnson Street, Philadelphia, Pennsylvania.
- INSULL, SAMUEL, President, Commonwealth Edison Company, 72 West Adams Street, Chicago, Illinois.

- IRONS, ROBERT HATFIELD**, President, Central Iron and Steel Company, Harrisburg, Pennsylvania.
- ISRAEL, JOSEPH D.**, District Manager, The Philadelphia Electric Company, 10th and Chestnut Streets, Philadelphia, Pennsylvania.
- ITTNER, MARTIN HILL**, Chief Chemist, Colgate and Company, Jersey City, New Jersey.
- IVES, FRED E.**, Inventor, 1327 Spruce Street, Philadelphia, Pennsylvania.
- IVES, Dr. HERBERT E.**, Physicist, in care of Western Electric Company, 463 West Street, New York City, New York.
- JACKSON, A. C.**, Manufacturer, 4530 Tacony Street, Philadelphia, Pennsylvania.
- JACKSON, JOHN PRICE**, Pennsylvania Commissioner of Labor and Industry, Harrisburg, Pennsylvania, and for mail, 129 Coulter Street, Ardmore, Pennsylvania.
- JACKSON, WILLIAM STEELL**, Patent Attorney, 1001 Chestnut Street, Philadelphia, Pennsylvania.
- JACOBUS, D. S.**, Advisory Engineer, The Babcock and Wilcox Company, 85 Liberty Street, New York City, New York.
- JEANES, ISAAC W.**, Room 908, Lafayette Building, Philadelphia, Pennsylvania.
- JEFFERSON, J. P.**, Manufacturer, P. O. Box 645, Santa Barbara, California.
- JEFFERIES, ZAY**, Metallurgical Engineer, in care of Aluminum Castings Company, 2800 Harvard Avenue, Cleveland, Ohio.
- JENKINS, C. FRANCIS**, Inventor, 5502 16th St., N. W., Washington, D. C.
- JENKINS, THEODORE F.**, Attorney-at-Law, 1100 Franklin Bank Building, Philadelphia, Pennsylvania.
- JENNINGS, W. N.**, Business Photographer, 1321 Arch Street, Philadelphia, Pennsylvania.
- JOB, ROBERT**, Vice President, Milton Hersey Company, Limited, 84 St. Antoine Street, Montreal, Quebec, Canada.
- JOHANSEN, ERNST**, Chemist, New England Oil Refining Company, Fall River, Massachusetts.
- JOHNSON, ERNEST EDWARD**, Professor of Physics, Northeast High School, and for mail, 201 W. Ontario Street, Philadelphia, Pennsylvania.
- JOHNSON, JAMES CURTIS**, General Superintendent of Transportation, Pennsylvania Railroad Company, Broad Street Station, Philadelphia, Pennsylvania.
- JOHNSON, WALTER H.**, First Vice President Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- JONES, JONATHAN**, Engineer, P. O. Box 1593, Pittsburgh, Pennsylvania.
- JONES, JONATHAN R.**, Iron and Steel Manufacturer, 1800 Widener Bldg., Philadelphia, Pennsylvania.
- JONES, JULIAN D.**, Superintendent, Telegraph and Signals, Eastern Region, Pennsylvania System, Room 152, Broad Street Station, Philadelphia, Pennsylvania.
- JONES, W. CLYDE**, Attorney-at-Law, 77 West Washington St., Chicago, Illinois.
- JUNKERSFELD, P.**, Engineer and General Supervisor in Electric Supply Business, in care of McClellan and Junkersfeld, Incorporated, 45 William Street, New York City, New York.
- JUSTI, HENRY M.**, 32nd and Spring Garden Sts., Philadelphia, Pennsylvania.
- KABAKJIAN, Dr. D. H.**, Assistant Professor of Physics, University of Pennsylvania, Philadelphia, Pennsylvania.
- KALTENTHALER, H. J.**, Manufacturer of Steam Specialties, 6457 Woodbine Ave., Overbrook, Philadelphia, Pennsylvania.
- KARRER, ENOCH**, Physicist, Nela Research Laboratory, Nela Park, Cleveland, Ohio.
- KAUFMAN, H. M.**, General Manager, Mutual Chemical Company of America, 110 William Street, New York City, New York.
- KAVANAUGH, WM. H.**, Professor of Experimental Engineering, Towne Scientific School, University of Pennsylvania, Philadelphia, Pennsylvania.
- KEBLER, LEONARD**, President, Ward Leonard Electric Company, Mt. Vernon, New York and for mail, Avon Road, Bronxville, New York.
- KEITH, C. P.**, in care of W. G. Peters, 69 Van Antwerp Road, Schenectady, New York.
- KELLER, F. E.**, Engineer and Manufacturer, Hotel Sagamore, Rochester, New York.
- KELLER, HARRY F.**, Educator and Chemist, 103 W. Upsal Street, Germantown, Philadelphia, Pennsylvania.
- KELLEY, Dr. GEORGE L.**, Research Chemist, 6804 McCallum Street, Philadelphia, Pennsylvania.
- KELLOGG, HOSFORD D.**, Manager, The H. B. Smith Company, 17th and Arch Streets, Philadelphia, Pennsylvania.
- KEMMERER, M. S.**, Coal Merchant, Mauch Chunk, Pennsylvania.
- KENNEDY, FRANK G., JR.**, President, Logan Iron and Steel Company, 1218 Stephen Girard Building, and for mail, 2043 Spruce Street, Philadelphia, Pennsylvania.
- KENNEDY, J. J.**, Consulting Engineer, 52 Broadway, New York City, New York.
- KENNEDY, M. C.**, Vice President, Pennsylvania Railroad Company, Broad Street Station, Philadelphia, Pennsylvania.
- KENNELLY, Dr. A. E.**, Professor of Electrical Engineering, Harvard University, Cambridge, Massachusetts.
- KENT, A. ATWATER**, Manufacturer, Ardmore, Pennsylvania.
- KENT S. LEONARD, Jr.**, Hydro-Electrics, Manayunk, Philadelphia, Pennsylvania.
- KERLIN, W. D.**, Secretary and Treasurer, Camden Forge Company, Camden, New Jersey.
- KERR, WILLIAM M.**, Manufacturer, 1421 Chestnut Street, Philadelphia, Pennsylvania.

- KETCHAM, O. W.**, Manufacturer of Architectural Terra Cotta, 24 South Seventh Street, Philadelphia, Pennsylvania.
- KETTERLINUS, J. L.**, Lithographer, 4th and Arch Streets, Philadelphia, Pennsylvania.
- KILPATRICK, J. L.**, 181 Ridgewood Avenue, Glen Ridge, N. J.
- KIMBER, WILLIAM M. C.**, Manufacturer of Electrical Instruments, Leeds and Northrup Company, 4901 Stenton Avenue, Germantown, Philadelphia, Pennsylvania.
- KINEALY, JOHN HENRY**, Consulting Engineer, 503 Granite Building, St. Louis, Missouri.
- KING, CHARLES W. G.**, Mechanical Engineer, 125 Linden Avenue, Rutledge, Delaware County, Pennsylvania.
- KING, JOSEPH B., Jr.**, Assistant in Research Laboratory, Electric Storage Battery Company, and for mail, 7315 Boyer Street, Mt. Airy, Philadelphia, Pennsylvania.
- KINGSBURY, Dr. EDWIN F.**, Physicist, Western Electric Company, 463 West Street, New York City, New York.
- KINNARD, L. H.**, President, The Bell Telephone Company, 1631 Arch Street, Philadelphia, Pennsylvania.
- KINNIER, GEORGE E.**, Civil Engineer, 94 Broad Street, Woodbury, New Jersey.
- KIPPENBERG, HENRY**, in care of Merck and Company, Rahway, New Jersey.
- KIRK, C. J.**, President, United States Sherardizing Company, New Castle, Pennsylvania.
- KLEMM, J. GEORGE, Jr.**, Heating and Ventilating Engineer, Box 284, Haverford, Pennsylvania.
- KLINE, C. MAHLON**, Wholesale Druggist, 429 Arch Street, Philadelphia, Pennsylvania.
- KLIPSTEIN, A.**, Merchant, 644-54 Greenwich Street, New York City, New York.
- KLUMPP, JOHN BARTLEMAN**, Inspecting Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- KNAPP, ARTHUR**, Petroleum Engineer, 210 Strathmore Road, Upper Darby, Philadelphia, Pennsylvania.
- KNAPP, I. N.**, Engineer, 504 Aspen Street, N. W., Takoma Park, D. C.
- KNEASS, STRICKLAND L.**, Mechanical Engineer, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- KNOEDLER, E. L.**, General Superintendent, The Welshbach Company, Gloucester, New Jersey.
- KNOX, HENRY HOBART**, Mining Engineer, 160 Broadway, New York City, New York.
- KOCH, GEORGE B.**, General Foreman, South Altoona Foundries, Pennsylvania Railroad Company, Altoona Pennsylvania.
- KOCH, JULIUS A.**, Professor of Chemistry and Dean of School of Pharmacy, University of Pittsburgh, Bluff and Pride Streets, Pittsburgh, Pennsylvania.
- KOHN, JOSEPH**, Secretary and Treasurer, Universal Dental Company, 2204 Natrona Street, Philadelphia, Pennsylvania.
- KOTHNY, G. L.**, Consulting Engineer, C. H. Wheeler Manufacturing Company, and for mail, Woodland Road, Strafford, Pennsylvania.
- KREBS, A. S.**, Mechanical Engineer, Krebs Pigment and Chemical Company, Newport, Delaware.
- KREBS, H. J.**, President, Krebs Pigment and Chemical Company, P. O. Box 951, Wilmington, Delaware.
- KRUTTSCHNITT, J.**, Civil Engineer, Southern Pacific Company, 165 Broadway, New York City, New York.
- KUESEL, Dr. GEORGE C.**, Dentist, 1614 Locust Street, Philadelphia, Pennsylvania.
- KUHN, C. HARTMAN**, 202 Liberty Building, Philadelphia, Pennsylvania.
- KUTTROFF, EDWIN**, President, Verona Chemical Company, North Newark, New Jersey.
- LAIRD, CLINTON N.**, Chemist, Canton Christian College, Canton, China.
- LANDRETH, C. P.**, Manufacturer, Electrolytic Purification Company, 15th Street and Lehigh Avenue, Philadelphia, Pennsylvania.
- LANE, DAVID H.** (Retired), 408 Land Title Building, Philadelphia, Pennsylvania.
- LANZA, GAETANO**, Engineer, Special Consultant, The Baldwin Locomotive Works, and for mail, The Montevista, 63rd and Oxford Streets, Philadelphia, Pennsylvania.
- LAUER, CONRAD**, General Manager, Day and Zimmermann, and for mail, 233 West Horner Street, Germantown, Philadelphia, Pennsylvania.
- LAVINO, E. J.**, Merchant, 471 Bullitt Building, Philadelphia, Pennsylvania.
- LAWALL, CHARLES H.**, Analytical Chemist, 636 Franklin Square, Philadelphia, Pennsylvania.
- LAWLER, G. S.**, Electrical Engineer, Associated Factory Mutual Fire Insurance Companies, Fort Hill Square, 184 High Street, Boston, Massachusetts.
- LAY, JOHN TRACY**, Research Assistant in Physics, University of Pennsylvania, and for mail, 4015 Pine Street, Philadelphia, Pennsylvania.
- LE BOUTILLIER, HENRY W.**, Chemist, Wayne, Pennsylvania.
- LE BOUTILLIER, ROBERT**, Wayne, Pennsylvania.
- LEDoux, J. W.**, Chief Engineer, American Pipe Manufacturing Company, 112 North Broad Street, Philadelphia, Pennsylvania.
- LEE, ELISHA**, General Manager, Pennsylvania Railroad Company, Broad Street Station, Philadelphia, Pennsylvania.
- LEE, JAMES D., Jr.**, 5929 Greene Street, Germantown, Philadelphia, Pennsylvania.
- LEE, WALTER T.**, Accountant, 308 Rex Avenue, Chestnut Hill, Philadelphia, Pennsylvania.

- LEEDS, MORRIS E., Manufacturer of Scientific Instruments, 4901 Stenton Avenue, Germantown, Philadelphia, Pennsylvania.
- LEFFMANN, HENRY, Chemist, 1839 North 17th Street, Philadelphia, Pennsylvania.
- LEIGHNINGER, WILLIAM B., Teacher, Chemistry, Frankford High School, and for mail, 1123 Harrison Street, Frankford, Philadelphia, Pennsylvania.
- LE MAISTRE, F. J., Chemical Engineer, 810 Bellevue Court Building, Philadelphia, Pennsylvania.
- LEMOINE, L. R., President, United States Cast Iron Pipe and Foundry Company, Morris Building, Philadelphia, Pennsylvania.
- LENHER, Major VICTOR, Chemist, 158 Summit Avenue, Madison, Wisconsin.
- LENKER, WILL G., Civil Engineer, 405 Chestnut Street, Sunbury, Pennsylvania.
- LESLEY, ROBERT W., Manufacturer, 612 Pennsylvania Building, Philadelphia, Pennsylvania.
- LEVY, HOWARD S., 1424 North Fifteenth Street, Philadelphia, Pennsylvania.
- LEVY, LIONEL FARADAY, Chemical Engineer, Manager, Repro Art Machinery Company, and for mail, 220 West Roberts Avenue, Philadelphia, Pennsylvania.
- LEVY, MAX, Manufacturer and Photo-Engraver, Lenox Apartments, 13th and Spruce Streets, Philadelphia, Pennsylvania.
- LEWIS, A. NELSON, Attorney-at-Law, 1811 Walnut Street, Philadelphia, Pennsylvania.
- LEWIS, DANIEL C., Agent, The Millville Manufacturing Company, Millville, New Jersey.
- LEWIS, GEORGE W., Mechanical Engineer, National Advisory Committee for Aeronautics 2722 Navy Building, Washington, D. C.
- LEWIS, HOWARD W., Banker, 1928 Spruce Street, Philadelphia, Pennsylvania.
- LEWIS, JOHN F., Attorney-at-Law, 208 South 4th Street, Philadelphia, Pennsylvania.
- LEWIS, NATHAN E., Mechanical Engineer, Babcock Wilcox Company, 85 Liberty Street, New York City, New York.
- LEWIS, PAUL A., Physician, Director of Laboratory, The Henry Phipps Institute, 7th and Lombard Streets, Philadelphia, Pennsylvania.
- LEWIS, ROBERT B., Mechanical Engineer, 51 East Penn Street, Germantown, Philadelphia, Pennsylvania.
- LEWIS, WILFRED, Mechanical Engineer, President, The Tabor Manufacturing Company, and for mail, Rose Lane, Haverford, Pennsylvania.
- LICHTENBERG, Captain CHESTER, Electrical Engineer, 136 Waverly Place, Schenectady, New York.
- LIEB, J. W., Vice President, The New York Edison Company, 15th Street and Irving Place, New York City, New York.
- LIEBER, HUGO, Chemist, President, H. Lieber and Company, 19 West 44th Street, New York City, New York.
- LIGHTFOOT, THOMAS M., Retired Educator, Chesham, New Hampshire.
- LIHME, I. P., Chemical Engineer, The Grasselli Chemical Company, Cleveland, Ohio.
- LILLIE, LEWIS, Vice President, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- LILLIE, S. MORRIS, President, Sugar Apparatus Refining Company, 4804 Springfield Avenue Philadelphia, Pennsylvania.
- LINDENTHAL, GUSTAV, Consulting Engineer, Room 738 Pennsylvania R. R. Station, New York City, New York.
- LIPPINCOTT, J. BERTRAM, Publisher, 229 South 6th Street, Philadelphia, Pennsylvania.
- LIPPINCOTT, JOSEPH W., Publisher, Bethayres, Pennsylvania.
- LITTLE, ARTHUR D., President, Arthur D. Little, Incorporated, 30 Charles River Road, Cambridge, Massachusetts.
- LIVERSIDGE, HORACE P., Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- LIVINGSTON, HERMAN, Hydro Carbon Engineer, Calco Chemical Company, Richards Park, Somerville, New Jersey.
- LLEWELLYN, W. H., Druggist, 1518 Chestnut Street, Philadelphia, Pennsylvania.
- LLOYD, HERBERT, President, Electric Storage Battery Company, Philadelphia, Pennsylvania.
- LLOYD, JOHN URI, Manufacturing Pharmacist and Chemist, Clifton and Lafayette Avenues, Cincinnati, Ohio.
- LLOYD, MORTON G., Electrical Engineer, Bureau of Standards, Washington, D. C.
- LOBBEN, PEDER, Mechanical Engineer, Room No. 2, Keyzers Gade 1, Kristiania, Norway.
- LODGE, ROLLA M., Engineer and Electrician, 1149 Venango Street, Philadelphia, Pennsylvania.
- LOEB, LEO, Mechanical Engineer, Day and Zimmermann, Incorporated, 1600 Walnut Street, Philadelphia, Pennsylvania, and for mail 333 West Seymour Street, Germantown, Philadelphia, Pennsylvania.
- LONGERAN, J. E., Brass Manufacturer, 211 Race Street, Philadelphia, Pennsylvania.
- LONGSTRETH, CHARLES, Box 326, Coronado, California.
- LONGSTRETH, EDWARD T., Manufacturer, 6805 North 11th Street, Oak Lane, Philadelphia, Pennsylvania.
- LORENTZ, HENDRIK A., Physicist, Zylweg 76, Haarlem, Holland.
- LOSS, HENRIK VON Z., Consulting Engineer, Atlantic City, New Jersey.
- LOVEJOY, J. R., Vice President, General Electric Company, Schenectady, New York.

- LOVEKIN, LUTHER D., Marine Engineer, Mill Creek Road, Ardmore, Pennsylvania.
- LOWE, ARTHUR W., Public School Teacher, 1224 Herbert Street, Frankford, Philadelphia, Pennsylvania.
- LOWER, NATHAN M., Assistant General Manager, Locomotive Stoker Company, 292 Balph Avenue, Bellevue, Pennsylvania.
- LOYD, SARAH A. C., 1206 Filbert Street, Philadelphia, Pennsylvania.
- LUCKE, CHARLES EDWARD, Professor of Mechanical Engineering, Columbia University, New York City, New York.
- LUCKIESH, Dr. M., Director of Applied Science, Nela Research Laboratories, Nela Park, Cleveland, Ohio.
- LUKENS, Dr. HIRAM S., Chemist, Harrison Laboratory, University of Pennsylvania, 34th and Spruce Streets, Philadelphia, Pennsylvania.
- LUPTON, EDWARD, Manufacturer of Sheet Metal, Allegheny Avenue and Tulip Street, Philadelphia, Pennsylvania.
- LYMAN, JAMES, Consulting Engineer, Member of Firm, Sargent & Lundy, 1412 Edison Building, Chicago, Illinois.
- LYNCH, JOHN COOPER, General Superintendent of Traffic, The Bell Telephone Company, of Pennsylvania, 1631 Arch Street, Philadelphia, Pennsylvania.
- LYON, PERCY S., Chief Engineer, H. S. B. W. Cochrane Corporation, 17th Street and Allegheny Avenue, Philadelphia, Pennsylvania.
- LYSLE, FREDERIC BOWERS, Chemist-Engineer, Room 900, City Hall, Philadelphia, Pennsylvania.
- MCBRIDE, THOS. C., Sales Manager, Worthington Pump and Machinery Corporation, 1516 N. American Building, Philadelphia, Pennsylvania.
- MCCAFFREY, EDWARD V., File Manufacturer, McCaffrey File Company, Fifth and Berks Streets, Philadelphia.
- MCCALL, JOSEPH B., President, Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- MCCALL, RICHARD C., 2115 Locust Street, Philadelphia, Pennsylvania.
- MCCHESENEY, JOHN M., General Manager, Keystone Leather Chemical Company, 150 West Central Avenue, Moorestown, New Jersey.
- MCCLELLAND, GEORGE W., Instructor in Mathematics, 3112 Troost Avenue, Kansas City, Missouri.
- MCCONNELL, FRANKLIN P., in care of Day and Zimmermann, Incorporated, 1600 Walnut Street, Philadelphia, Pennsylvania.
- MCCONNELL, JACOB Y., Mechanical Engineer, 100 S. 4th Street, Darby, Pennsylvania.
- MCCORMACK, H., Professor of Chemical Engineering, Armour Institute of Technology, Chicago, Illinois.
- MCDONALD, HUNTER, Chief Engineer, N. C. & St. L. Ry. Company, 112 Tenth Avenue, North Nashville, Tennessee.
- MCFADDEN, GEORGE H., Merchant, 121 Chestnut Street, Philadelphia, Pennsylvania.
- MCGEORGE, PERCY, 711 Bullitt Building, Philadelphia, Pennsylvania.
- MCGOWAN, J. Jr., Chief Chemist, Joseph Campbell Company, 32 N. Front Street, Camden, New Jersey.
- MCILHENNY, JOHN D., 17th and Clearfield Streets, Philadelphia, Pennsylvania.
- MCRAIG, W. WALLACE, Mechanical Engineer, Cumberland, Maryland.
- MCKEEHAN, Dr. L. W., Research Physicist, Western Electric Company, 463 West Street, New York City, New York.
- MCLEAN, WILLIAM I., Publisher, The Evening Bulletin, Philadelphia, Pennsylvania.
- MCMEKIN, MARY C. W., 345 Rialto Building, San Francisco, California.
- MEVEY, JOHN JOSEPH, Publisher & Bookbinder, 1229 Arch Street, Philadelphia, Pennsylvania.
- MERRAIN, D. F., Assistant General Manager, New York Central Railroad Company, Cleveland, Ohio.
- MERBETH, NORMAN, Illuminating Engineer, 227 West 17th Street, New York City, New York.
- MCGREGOR, FRANK S., Development Department, F. I. de Pont de Nemours and Company, 452 De Pont Building, Wilmington, Delaware.
- MACKENZIE, K. G., Consulting Chemist, The Texas Company, 17 Battery Place, New York City, New York.
- MALFAN, GEORGE, President, Ives Investments, 208 West 88th Street, New York City, New York.
- MALFAN, MALCOLM R., Mechanical Engineer, Havertown, Pennsylvania.
- MADEIRA, PERCY C., Coal Operator, North American Building, Philadelphia, Pennsylvania.
- MALLOUX, Dr. C. O., Consulting Engineer, 121 Fifth Avenue, New York City, New York.
- WATLAND, HAROLD T., Of Chemist, Shaver Hill, Pennsylvania.
- WATKINS, Dr. ISRAEL, Instructor in Physics, Lehigh University, Bethlehem, Pennsylvania.
- WALLINCKHOFF, E. Jr., Manufacturing Chemist, Mallinckhoff Chemical Works, St. Louis, Missouri.
- WANWAKING, ALBERT H., Electrical Engineer, The Philadelphia Electric Company, 3001 Chestnut Street, Philadelphia, Pennsylvania.
- WASSERMAN, Dr. EDWARD, Chemist, Mellon Institute, Pittsburgh, Pennsylvania.

- MARCONI, GUGLIELMO**, Senator, Electrical Engineer and Inventor, 31 Via Garibaldi Gianicolo, Rome, Italy.
- MARKLE, A.**, Mining Engineer, Hazleton, Pennsylvania.
- MARKLE, JOHN**, Mining Engineer and Coal Operator, 2 Rector Street, New York City, New York.
- MARSHALL, THOS. H.**, Carpenter and Builder, Carpenter's Hall, 320 Chestnut Street, Philadelphia, Pennsylvania.
- MARTIN, T. COMMERFORD**, Advisory Secretary, National Electric Light Association, 29 West 39th Street, New York City, New York, and for mail, 32 Grove Avenue, Larchmont Manor, New York.
- MARTIN, THOMAS S.**, 3rd, Civil Engineer, 7205 Cresheim Road, Germantown, Philadelphia, Pennsylvania.
- MARTOCCELLO, JOSEPH A.**, Manufacturer Raw Water Ice Making Appliances, 229 North 13th Street, Philadelphia, Pennsylvania.
- MASLAND, CHARLES H.**, 2nd, Chemical Engineer, 1202 Stratford Avenue, Melrose Park, Pennsylvania.
- MASLAND, CHARLES WILLIAM**, Manufacturer, 3240 Amber Street, Philadelphia, Pennsylvania.
- MASON, CHARLES THOMAS**, Electrical Engineer, President, Sumter Electric Company, Sumter, South Carolina.
- MASON, SIDNEY**, President, Welsbach Company, Gloucester City, New Jersey.
- MASON, W. P.**, Professor of Chemistry, Rensselaer Polytechnic Institute, Troy, New York.
- MASTERS, Major FRANK M.**, Chief Inspector, 204 Locust Street, Harrisburg, Pennsylvania.
- MAXFIELD, H. H.**, General Superintendent, Pennsylvania System, 402 Pennsylvania Building, Wilmington, Delaware.
- MAYER, NELSON B.**, Merchant, Hotel Marie Antoinette, Broadway and 67th Street, New York City, New York.
- MEASEY, WILLIAM MAUL**, Attorney-at-Law, 1328 Chestnut Street, and for mail, Box 208, Haverford, Pennsylvania.
- MEEKER, G. H.**, Professor of Chemistry, School of Medicine, University of Pennsylvania.
- MEES, Dr. C. E. KENNETH**, Director, Research Laboratory, Eastman Kodak Company, Rochester, New York.
- MELCHER, WM. C., Jr.**, c/o I. P. Morris Department, William Cramp and Sons, Ship and Engine Building Company, Philadelphia, Pennsylvania.
- MELLOR, NORMAN**, Manufacturer, Wayne Junction, Philadelphia, Pennsylvania.
- MELODY, MICHAEL**, Bailey Building, Philadelphia, Pennsylvania.
- MENDENHALL, Dr. T. C.**, Retired, Ravenna, Ohio.
- MERRICK, JAMES HARTLEY**, Acting Vice Provost, University of Pennsylvania, and for mail, No. 20 Cleemann House, University Dormitories, Philadelphia, Pennsylvania.
- MERRICK, J. V.**, Roxborough, Philadelphia, Pennsylvania.
- MERRIMAN, THADDEUS**, Department Engineer, Board of Water Supply, Municipal Building, New York City, New York.
- MERRITT, JAMES SMITH**, Mechanical Engineer, Abington, Pennsylvania.
- MERSHON, R. D.**, Consulting Engineer, Electric Testing Laboratories, 80th Street and East End Avenue, New York City, New York.
- MERZ, CHARLES H.**, Consulting Engineer, 32 Victoria Street, London, S. W., England.
- MERZ, EUGENE**, Manufacturer, The Heller and Merz Company, Hamburg Place, Newark, New Jersey.
- METTEN, JOHN F.**, Chief Engineer, Wm. Cramp & Sons, Ship & Engine Building Company, Richmond and Norris Streets, Philadelphia, Pennsylvania.
- METZ, HERMAN A.**, Manufacturer and Importer of Chemicals and Dyestuffs, 122 Hudson Street, New York City, New York.
- MICHELSON A. A.**, Professor of Physics, University of Chicago, Chicago, Illinois.
- MIDDLETON, ALBERT C.**, Director, 149 East Main Street, Moorestown, New Jersey.
- MILES, J. WALTER**, Electrical Engineer, Irwin, Pennsylvania.
- MILLER, CASPER W.**, Physician, Wallingford, Pennsylvania.
- MILLER, FRED J.**, Factory Manager, New Hope, Pennsylvania.
- MILLER, SIMON**, Textile Manufacturer, 901 North 16th St., Philadelphia, Pa.
- MILLER, W. LASH**, Professor of Physical Chemistry, 8 Hawthorne Avenue, Toronto, Canada.
- MILLIKEN, J.**, President, Pittsburgh Testing Laboratories, P. O. Box 115, Pittsburgh, Pennsylvania.
- MILLS, GEO. M.**, President, Thomas Mills and Brothers, Incorporated, 1301 North 8th Street, Philadelphia, Pennsylvania.
- MILNE, DAVID**, Manufacturer, School House Lane, Germantown, Philadelphia, Pennsylvania.
- MILNE, FRANCIS F., Jr.**, 1714 Spruce Street, Philadelphia, Pennsylvania.
- MILNER, B. B.**, Engineer of Motive Power, Hartford, Kansas.
- MINER, HARLAN S.**, Chief Chemist, Welsbach Company, Gloucester, New Jersey.

- MISSIMER, GEORGE, Jr.**, Farmer, West Port Royal Avenue, Roxborough, Philadelphia, Pennsylvania.
- MITCHELL, HENRY F.**, Glazed Kid Manufacturer, 36th and Reed Streets, Philadelphia, Pennsylvania.
- MITCHELL, Dr. WALTER M.**, Metallurgical Engineer, Chemical Department, E. I. du Pont de Nemours and Company, Wilmington, Delaware, and for mail, 112 North 34th Street, Philadelphia, Pennsylvania.
- MITCHESON, JOSEPH MacGREGOR**, Assistant City Solicitor, 1018 Stock Exchange Building, Philadelphia, Pennsylvania.
- MITTEN, T. E.**, Chairman of Executive Committee, Philadelphia Rapid Transit Company, 1520 Spruce Street, Philadelphia, Pennsylvania.
- MIXER, CHARLES A.**, Engineer, Rumford Falls Power Company, Rumford, Maine.
- MODJESKI, RALPH**, Consulting Civil Engineer, 818 Widener Building, Philadelphia, Pennsylvania.
- MOODY, LEWIS FERRY**, Consulting Engineer, William Cramp and Sons Ship and Engine Building Company, Richmond and Norris Streets, Philadelphia, Pennsylvania.
- MOORE, ALFRED**, Attorney-at-Law, 618 North American Building, Philadelphia, Pennsylvania.
- MOORE, DAVID PELTON**, Patent Attorney, Warder Building, Washington, D. C.
- MOORE, HORACE E.**, Superintendent, Chester Heights, Delaware County, Pennsylvania.
- MOORE, W. E.**, Vice President and General Manager, West Penn Traction Company, Room 705, Union Bank Building, Pittsburgh, Pennsylvania.
- MORAN, ROBERT**, (Retired), Rosario, San Juan County, Washington.
- MORGAN, D. BRUCE**, Consulting Engineer, 238 East 32nd Street, Flatbush, Brooklyn, New York.
- MORGAN, MARSHALL S.**, Fidelity Trust Company, 325 Chestnut Street, Philadelphia, Pennsylvania.
- MORGAN, RANDAL**, First Vice President, United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- MORRIS, A. SAUNDERS**, Mechanical Engineer, Haverford, Pennsylvania.
- MORRIS, EFFINGHAM B.**, Girard Trust Company, Philadelphia, Pennsylvania.
- MOYER, J. A.**, Director, Massachusetts Board of Education, State House, Boston, Massachusetts.
- MULL, J. HARRY**, President and General Manager, The William Cramp & Sons, Ship and Engine Building Company, Richmond and Norris Streets, Philadelphia, Pennsylvania.
- MULLER, EDWARD ALBERT**, Vice President and Secretary, The King Machine Tool Company, and for mail, 839 Mitchell Avenue, Avondale, Cincinnati, Ohio.
- MULLER, RALPH H.**, Chemical Engineer, 485 Rogers Avenue, Brooklyn, New York.
- MUNROE, Captain CHARLES W.** (Retired), 205 Elm Avenue, Swarthmore, Pennsylvania.
- MURDOCK, JOSEPH B.**, Rear Admiral, U. S. N. (Retired), Danbury, New Hampshire.
- MURRAY, B. L.**, Chemist, Merck and Company, Rahway, New Jersey.
- MURRAY, J. F.**, Assistant to Chief Engineer, Pennsylvania Railroad Company, 607 Broad Street Station, Philadelphia, Pennsylvania.
- MURRAY, THOMAS E.**, Consulting Electrical Engineer, 124 East 15th Street, New York City, New York.
- MURRAY, WILLIAM S.**, Consulting Engineer, 709 Sixth Avenue, New York City, New York.
- MYERS, ALLEN I.**, 565 West 113th Street, New York City, New York.
- NEEDLES, A. C.**, General Manager, Norfolk and Western Railway Company, Roanoke, Virginia.
- NEILER, SAMUEL G.**, Consulting Mechanical and Electrical Engineer, 1409 Manhattan Building, Chicago, Illinois.
- NELL, PHILIP**, 3619 North Marshall Street, Philadelphia, Pennsylvania.
- NETHERY, JOHN E.** (Retired), Address unknown.
- NEWBOLD, CLEMENT B.**, Banker 511 Chestnut Street, Philadelphia, Pennsylvania.
- NICE, EUGENE E.**, Manufacturer, 272 South 2nd Street, Philadelphia, Pennsylvania.
- NICHOLS, CARROLL B.**, 1214 Widener Building, Philadelphia, Pennsylvania.
- NICHOLS, LEON W.**, Chemist, Glenolden, Pennsylvania.
- NICHOLS, Dr. WILLIAM H.**, Consulting Chemist, Chairman of Board of Directors, The Allied Chemical and Dye Corporation, 61 Broadway, New York City, New York.
- NORMAN, BRADFORD**, Farmer, Newport, Rhode Island.
- NORMAN, REGINALD**, Farmer, Newport, Rhode Island.
- NORRIS, GEORGE L.**, Tool Specialist, 222 West 2nd Street, Wilmington, Delaware.
- NORTH, R. H.**, North Brothers Manufacturing Company, Lehigh Avenue and American Street, Philadelphia, Pennsylvania.
- NORTHRUP, EDWIN FITCH**, Research Physicist, Palmer Physical Laboratory, Princeton, New Jersey.
- NOYES, STEPHEN H.**, Civil Engineer, Bureau of Surveys, City Hall, Philadelphia, Pennsylvania.
- NUTTING, Dr. P. G.**, Director of Research, 107 South Church Street, Schenectady, New York.
- OATLEY, H. B.**, Chief Engineer, Locomotive Superheater Company, 145 Wilson Avenue, Flushing, New York.

- OBERLY, ALBERT D., Civil Engineer, Scottdale, Pennsylvania.
- OHMER, WILL I., President, Recording and Computing Machines Company, Dayton, Ohio.
- OLSEN, THORSTEN Y., Vice President and Treasurer, Tinius Olsen Testing Machine Company, 500 North 12th Street, Philadelphia, Pennsylvania.
- OLSEN, TINNIUS, Mechanical Engineer, 500 North 12th Street, Philadelphia, Pennsylvania.
- ONNES, HEIKE KAMERLINGH, Physicist, University of Leiden, Leiden, Holland.
- ORROK, GEORGE A., Consulting Engineer, 17 Battery Place, New York City, New York, and for mail, R. F. D. No. 2, Willimantic, Connecticut.
- ORUM, MORRIS L., Manufacturer of Wood Working Machinery, 1320 North 19th Street, Philadelphia, Pennsylvania.
- OSBORNE, L. A., Vice President, Westinghouse Electric and Manufacturing Company, 165 Broadway, New York City, New York.
- OTIS, SPENCER, Manufacturer, Railway Exchange Building, Chicago, Illinois.
- OTT, G. F., President, George F. Ott Company, 325 Hansberry Street, Philadelphia, Pennsylvania.
- OUTERBRIDGE, ALEXANDER E., Jr., Metallurgist, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- OWEN, BARTRAM ASHMEAD, Civil Engineer, 411 Pine Street, Philadelphia, Pennsylvania.
- PALMER, Dr. FREDERIC, Jr., Professor of Physics, Haverford College, Haverford, Pennsylvania.
- PALMER, T. CHALKLEY, 2nd Vice President, American Dyewood Company, and for mail, Chester, Pennsylvania.
- PALMER, WALTER, Engineer, American Dyewood Company, and for mail, 105 West 23rd Street, Chester, Pennsylvania.
- PARISH, LE GRAND, President, American Arch Company, Inc., 17 East 42nd Street, New York City, New York.
- PARKER, EDWARD W., Statistician and Economist, 437 Chestnut Street, Philadelphia, Pennsylvania.
- PARKER, JOHN C., in care of Lefax, Inc., Sheridan Building, Philadelphia, Pennsylvania.
- PARR, S. W., Professor of Applied Chemistry, 107 Chemistry Building, Urbana, Illinois.
- PARSONS, Sir CHARLES A., K.C.B., 6 Windsor Terrace, Newcastle-on-Tyne, England.
- PATTERSON, C. STUART, Banker, Western Saving and Society of Philadelphia, 1007 Walnut Street, Philadelphia, Pennsylvania.
- PATTERSON, FRANCIS D., Physician, Chief of Division of Industrial Hygiene and Engineering, Department of Labor and Industry, Harrisburg, and for mail, 3500 Grays Ferry Road, Philadelphia, Pennsylvania.
- PATTERSON, J. EDWARD, Vice President, Arthur H. Thomas Company, 230 South 7th Street, Philadelphia, Pennsylvania.
- PAUL, H. N., Attorney-at-Law, 1815 Land Title Building, Philadelphia, Pennsylvania.
- PAUL, LAWRENCE T., Consulting Engineer, 105 Liberty Building, Broad and Chestnut Streets, Philadelphia, Pennsylvania.
- PEACOCK, S., Manufacturer of Chemist's Supplies, Wheeling Steel Building, Wheeling, West Virginia.
- PEACOCK, SELINA EMMA, Organist, 1919 Master Street, Philadelphia, Pennsylvania.
- PEARSON, FREDERICK J., 25 East Washington Street, Chicago, Illinois.
- PEARSON, JOSHUA A., Purchasing Agent, The United Gas Improvement Company, 1410 Arch Street, Philadelphia, Pennsylvania.
- PEASE, F. N., Chief Chemist, Pennsylvania Railroad Company, P. O. Box 503, Altoona, Pennsylvania.
- PEASE, FRANCIS G., Astronomical Engineer, Mt. Wilson Solar Observatory, Pasadena, California.
- PECK, G. L., Vice President, Personnel Department Pennsylvania System, Broad Street Station, Philadelphia, Pennsylvania.
- PEMBERTON, HENRY R., Student, Prospect Avenue, Chestnut Hill, Philadelphia, Pennsylvania.
- PENDER, HAROLD, Professor of Electrical Engineering, Dean, Moore School of Electrical Engineering, University of Pennsylvania, Philadelphia, Pennsylvania.
- PENNOCK, GEO. L., Florist, 165 West Essex Avenue, Lansdowne, Pennsylvania.
- PENROSE, CHARLES, Electrical Engineer, in care of Day and Zimmermann, 1600 Walnut Street, Philadelphia, Pennsylvania.
- PENROSE, R. A. F., Jr., Geologist, 460 Bullitt Building, Philadelphia, Pennsylvania.
- PEPPER, DAVID, Engineer, Commonwealth Building, Philadelphia, Pennsylvania.
- PEROT, T. MORRIS, Jr., Malt Manufacturer, 808 Lafayette Building, Philadelphia, Pennsylvania.
- PERROT, EMILE G., Architect and Engineer, Boyertown Building, 1211 Arch Street Philadelphia, Pennsylvania.
- PERRY, ROBERT S., President, Franklin H. Kalbfleisch Company, 31 Union Square, West, New York City, New York.
- PERSHING, General JOHN J., War Department, Washington, D. C.
- PEW, J. HOWARD, President, Sun Oil Company, and Sun Shipbuilding Company, Finance Building, Philadelphia, Pennsylvania.
- PHILIPS, EDWIN S., President, Philbrin Corporation, Kennett Square, Pennsylvania.

- PIERCE, G. A., Electrical Engineer, Wm. Cramp & Sons Ship and Engine Building Company, Philadelphia, Pennsylvania.
- PITMAN, Brig. General JOHN (Retired), 611 Berkeley Avenue, Orange, New Jersey.
- PLACK, L. W., Architect and Structural Engineer, S. W. Corner 12th and Locust Streets, Philadelphia, Pennsylvania.
- PLATT, H. H., Mechanical Engineer, Wallingford, Pennsylvania.
- POPE, RALPH W., Honorary Secretary, American Institute of Electrical Engineers, 570 Cherry Street, Elizabeth, New Jersey.
- PORTER, Dr. HORACE C., Consulting Chemist and Chemical Engineer, 1833 Chestnut Street, Philadelphia, Pennsylvania.
- PORTER, J. BENTON, Electrical Engineer, 1527 Spruce Street, Philadelphia, Pennsylvania.
- PORTER, ROLAND, G., Gas Engineer, Swarthmore, Pennsylvania.
- POSER, Dr. M., 16 Vick Park B, Rochester, New York.
- POSTLETHWAITE, C. E., General Sales Manager, Pressed Steel Car Company, 55 Broad Street, New York City, New York.
- POTTS, JOSHUA, R. H., Attorney-at-Law, 929 Chestnut Street, Philadelphia, Pennsylvania.
- POTTS, WILLIAM M., Civil Engineer, Wyebrooke, Chester County, Pennsylvania.
- POWER, Dr. A. DRAYTON, Physicist, University of Minnesota, Minneapolis, Minnesota.
- PRATT, CARL D., Chemist, 412 West Broad Street, Tamaqua, Pennsylvania.
- PRICE, MAX CHARLES, Architect, Punta Gorda, Florida.
- PRICE, MORTON MOORE, Sales Agent, The Babcock and Wilcox Company, 1010 North American Building, Philadelphia, Pennsylvania.
- PURCELL, JOHN, Assistant to Vice President, Atchison, Topeka and Santa Fe Railway Company, 80 East Jackson Boulevard, Chicago, Illinois.
- QUIMBY, HENRY H., Consulting Structural Engineer, 3920 Girard Avenue, Philadelphia, Pennsylvania.
- QUINN, C. H., Chief Electrical Engineer, Norfolk and Western Railway Company, Roanoke, Virginia.
- RAMSBURG, C. J., Vice President, The Koppers Company, Pittsburgh, Pennsylvania.
- RAMSEY, GEORGE W., Patent Attorney, Woolworth Building, New York City, New York.
- RANGER, RICHARD H., Radio Engineer, 66 Broad Street, New York City, New York.
- RAPP, I. M., Physicist, State University, Missoula, Montana.
- RAU, ALBERT GEORGE, Professor of Mathematics and Dean, Moravian College and Theological Seminary, Bethlehem, Pennsylvania.
- RAUTENSTRAUCH, WALTER, Professor of Mechanical Engineering, 43 Exchange Place, New York City, New York.
- RAYMOND, WARD, Mechanical Engineer, 908 Paxinosa Avenue, Easton, Pennsylvania.
- REA, SAMUEL, President, Pennsylvania Railroad Company, Broad Street Station, Philadelphia, Pennsylvania.
- REATH, THEODORE W., Attorney-at-Law, 1201 Commercial Trust Building, Philadelphia, Pennsylvania.
- REBER, Colonel SAMUEL, 27 Van Dam Street, New York City, New York.
- REBMANN, G. R., Vice President, Otis Elevator Company, 16th & Sansom Streets, Philadelphia, Pennsylvania.
- REDFIELD, ROBERT S., Wayne, Pennsylvania.
- REED, G. BERKELEY, Inventor, Rowayton, Connecticut.
- REESE, CHARLES L., Chemical Engineer, E. I. du Pont de Nemours & Company, Wilmington, Delaware.
- REICHHARDT, HENRY (Retired), 3581 Queen Lane, East Falls, Philadelphia, Pennsylvania.
- REILLY, MARION, 2015 DeLancey Place, Philadelphia, Pennsylvania.
- RENO, JESSE W., Consulting Engineer, 684 St. Nicholas Avenue, New York City, New York.
- REOCH, ALEXANDER ERNEST, Electrical Engineer, The Radio Corporation of America, 233 Broadway, New York City, New York.
- RESINES, JAVIER, Industrial Chemist, Racquet Club, Philadelphia, Pennsylvania.
- RHOADS, J. J., Superintendent, Pennsylvania Railroad Company, and for mail, Miller Park, Franklin, Pennsylvania.
- RICE, CHARLES D., Manager of Factory, Underwood Typewriter Company, 581 Capitol Avenue, Hartford, Connecticut.
- RICE, E. W. Jr., Electrical Engineer, President, General Electric Company, Schenectady, New York.
- RICHARDS, EDGAR, Retired Chemist, 60 Ayrault Street, Newport, Rhode Island.
- RICHARDS, THEODORE WM., Director, Wolcott Gibbs Memorial Laboratory, Harvard University, Cambridge, Massachusetts.
- RICHARDSON, CHARLES E., Engineer, Chas. E. Richardson and Company, Engineers, 18 East 60th Street, New York City, New York.
- RICKETTS, L. D., Mining Engineer, Warren, Arizona.
- RIDGWAY, ELLIS B., Manufacturer, 367 West Main Street, Coatesville, Pennsylvania.
- RIDGWAY, ROBERT, Engineer, in care of Public Service Company, 49 Lafayette Street, New York City, New York.

- RIDGWAY, WILLIAM H., Civil Engineer and Manufacturer, The Craig Ridgway and Son Company, Coatesville, Pennsylvania.
- RIEHLE, FRED A., Testing Machine Manufacturer, 1424 North 9th Street, Philadelphia, Pennsylvania.
- RIGLING, ALFRED, Librarian, The Franklin Institute, and for mail, 4835 Haverford Avenue, Philadelphia, Pennsylvania.
- RILEY, LEWIS A., Civil and Mining Engineer, Lafayette Building, 437 Chestnut Street, Philadelphia, Pennsylvania.
- RILLIET, CHARLES E., Teacher, 4100-06 South Vermont Avenue, Los Angeles, California.
- RINGWALT, ROLAND, Clergyman, 3016 Carman Street, Camden, New Jersey.
- RITTENHOUSE, EDWARD, Chemical Engineer, Aldan, Pennsylvania.
- RITTER, LOUIS E., Consulting Civil Engineer, 1707 Marquette Building, Chicago, Illinois.
- RITTMAN, Dr. W. F., Chemical Engineer, Carnegie Institute of Technology, Pittsburgh, Pennsylvania.
- ROBB, RUSSELL, Member of Firm, Stone and Webster Engineering Corporation, 147 Milk Street, Boston, Massachusetts.
- ROBERTS, CHARLES C., Chemist, Arthur H. Thomas Company, Philadelphia, and for mail, 75 West La Crosse Avenue, Lansdowne, Pennsylvania.
- ROBERTS, WILMER, Palmyra, New Jersey.
- ROBINSON, ANTHONY W., Insurance, 6 College Avenue, Haverford, Pennsylvania.
- ROBINSON, DWIGHT P., Consulting Engineer, 49 East 52nd Street, New York City, New York.
- ROBINSON, EDMUND G., Chemist, 909 Nottingham Road, Wilmington, Delaware.
- RODMAN, HUGH, Engineer and Manufacturer, in care of Rodman Chemical Company, Verona, Pennsylvania.
- ROESSLER, FRANZ, Manufacturing Chemist, 89 High Street, Perth Amboy, New Jersey.
- ROGERS, Dr. ALLEN, Teacher, Pratt Institute, Brooklyn, New York.
- ROGERS, MRS. AUGENE P., 4007 Powelton Avenue, Philadelphia, Pennsylvania.
- ROGERS, FRANK H., Mechanical Engineer, William Cramp and Sons, Ship and Engine Building Company, Philadelphia, Pennsylvania.
- ROGERS, JAMES S., Attorney-at-Law, 701 Commonwealth Trust Building, Philadelphia, Pennsylvania.
- ROLLE, SYLVAN D., Draftsman, The Bell Telephone Company of Pennsylvania, and for mail, 2143 North 19th Street, Philadelphia, Pennsylvania.
- ROLLER, FRANK W., Electrical and Mechanical Engineer, 233 Broadway, New York City, New York.
- RONDINELLA, L. F., Head of Drawing and Designing, West Philadelphia High School for Boys, 48th and Walnut Streets, Philadelphia, Pennsylvania.
- ROONEY, FREDERICK M., General Manager, Hiergesell Brothers, 2007-13 Bellevue Avenue, Philadelphia, Pennsylvania.
- ROSENBAUM, MORRIS, Foreign Exchange, 605 South 3rd Street, Philadelphia, Pennsylvania.
- ROSENBAUM, W. A., Patent Attorney, 41 Park Row, New York City, New York.
- ROSENGARTEN, FREDERIC, Manufacturing Chemist, P. O. Box 1625, Philadelphia, Pennsylvania.
- ROSENGARTEN, GEORGE D., Manufacturing Chemist, P. O. Box 1625, Philadelphia, Pennsylvania.
- ROSIN, JOSEPH, Chemist, Powers-Weightman-Rosengarten Company, 9th and Parish Streets, Philadelphia, Pennsylvania.
- ROSS, T. EDWARD, Certified Public Accountant, 1209 Morris Building, Philadelphia, Pennsylvania.
- ROWLAND, CHARLES B., Vice President, Continental Iron Works, West and Calyer Streets, Brooklyn, New York.
- ROWLAND, THEODORE S., Head of Science Department, North East High School, and for mail, 6311 N. Camac Street, Philadelphia, Pennsylvania.
- RUGG, W. S., The University Club, 4439 Grant Boulevard, Pittsburgh, Pennsylvania.
- RUMBOUGH, JOHN B., Consulting Mechanical Engineer, R. F. D. No. 1, Ardan, North Carolina.
- RUMELY, W. N., 3020 Sheridan Road, Chicago, Illinois.
- RUSBY, J. M., Engineer of Tests, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- RUSSELL, CHARLES J., Manager, Sales Department, The Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- RUTHERFORD, Major HARRY K., Frankford Arsenal, Philadelphia, Pennsylvania.
- SADTLER, SAMUEL P., Consulting Chemist, 210 South 13th Street, Philadelphia, Pennsylvania.
- SADTLER, SAMUEL S., Consulting Chemist, 210 South 13th Street, Philadelphia, Pennsylvania.
- SAEGMULLER, G. N., Vice President, in care of Bausch and Lomb Optical Company, Rochester, New York.

- SAGEBEER, RICHARD G.**, Teaching Fellow, Haverford College, Haverford, Pennsylvania.
- SALMON, FREDERICK W.**, Civil and Mechanical Engineer, Richmond, Virginia.
- SALOM, PEDRO G.**, Electro-Chemical Engineer, Commonwealth Trust Building, Philadelphia, Pennsylvania.
- SAMUEL, J. BUNFORD**, Retired Iron Merchant, 1609 Spruce Street, Philadelphia, Pennsylvania.
- SANBORN, EDWARD H.**, Coal Mining, 1100 Commercial Trust Building, Philadelphia, Pennsylvania.
- SANDERSON, R. P. C.**, in care of The Baldwin Locomotive Works, 34 Victoria Street, London, England.
- SANDT, A. R.**, Consulting Engineer, 716-18 Metropolitan Life Building, Minneapolis, Minnesota.
- SANFORD, RUFUS H.**, Librarian, The Baldwin Locomotive Works, Philadelphia, Pennsylvania.
- SARGENT, C. E.**, Research Engineer, 143 Center Street, Bryan, Ohio.
- SARGENT, HENRY B.**, Hardware Manufacturer, 247 Church Street, New Haven, Connecticut.
- SARTAIN, PAUL J.**, Physician, 2006 Walnut Street, Philadelphia, Pennsylvania.
- SARTAIN, WILLIAM**, Artist, 140 West 57th Street, New York City, New York.
- SATTERTHWAITE, GEORGE**, Manufacturer of Steel, in care of Tacony Steel Company, Philadelphia, Pennsylvania.
- SAUER, FRANK H.**, Draftsman, 1307 Atlantic Avenue, Camden, New Jersey.
- SAUNDERS, WALTER M.**, Analytical and Consulting Chemist, 20 Dewey Street, Olneyville, Providence, Rhode Island.
- SAUNDERS, WILLIAM E.**, Librarian, U. G. I. Building, Broad and Arch Streets, Philadelphia, Pennsylvania.
- SAWELLE, WILLIAM OTIS**, Professor of Physics, Haverford College, Haverford, Pennsylvania.
- SCATTERGOOD, HENRY W.**, Manufacturer, 530 Land Title Building, Philadelphia, Pennsylvania.
- SCHAEFER, GEORGE F.**, 5th and Cherry Streets, Philadelphia, Pennsylvania.
- SCHIEHL, OSCAR L.**, Mechanical Engineer, 1631 Girard Avenue, Philadelphia, Pennsylvania.
- SCHLAFGE, WILLIAM S.**, General Mechanical Superintendent, Erie Railroad Company, 50 Church Street, New York City, New York.
- SCHLICKE, C. P.**, Treasurer and Secretary, 191 Berkeley Place, Brooklyn, New York.
- SCHROM, OSCAR G.**, Mechanical Engineer, 6017 Nassau Street, Philadelphia, Pennsylvania.
- SCOTT, WM. M.**, Draftsman, Box 76, Radnor, Pennsylvania.
- SEELY, LESLIE B.**, Teacher, 5918 Pulaski Avenue, Germantown, Philadelphia, Pennsylvania.
- SELGA, M.**, Meteorologist and Astronomer, Manila Observatory, Manila, Philippine Islands.
- SELLERS, ALEXANDER**, Manufacturer, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- SELLERS, COLEMAN**, 3rd, Mechanical Engineer, Wm. Sellers & Company, Inc., 1600 Hamilton Street, Philadelphia, Pennsylvania.
- SELLERS, HORACE W.**, Architect, Ardmore, Pennsylvania.
- SELLERS, HOWARD**, Millbourne House, Millbourne, Pennsylvania.
- SELLERS, RICHARD C.**, Civil Engineer, Swarthmore, Pennsylvania.
- SELLERS, RICHARD C.**, Civil Engineer, Swarthmore, Pennsylvania.
- SELLERS, MRS. WILLIAM**, Bellevue, Delaware.
- SELLERS, WILLIAM F.**, Manufacturer of Water Tube Boilers, Edge Moor, Delaware.
- SEVERY, MELVIN L.**, Inventor and Author, 431 South Berendo Street, Los Angeles, California.
- SHACKELFORD, BENJAMIN E.**, Physicist, Westinghouse Lamp Company, Bloomfield, New Jersey.
- SHAND, A. C.**, Civil Engineer, Narbeth, Pennsylvania.
- SHARER, CARL W.**, Superintendent of Equipment, The Keystone Telephone Company, and for mail, 446 East Walnut Lane, Germantown, Philadelphia, Pennsylvania.
- SHARP, Dr. CLAYTON H.**, Technical Director, Electrical Testing Laboratories, 80th Street and East End Avenue, New York City, New York.
- SHARP, W. H.**, Paper Manufacturer, The Wellington, 19th and Walnut Streets, Philadelphia, Pennsylvania.
- SHARPLES, STEPHEN P.**, Chemical Engineer, 22 Concord Avenue, Cambridge, Massachusetts.
- SHATTUCK, A. F.**, Chief Chemist, Solvay Process Company, and for mail, 614 Canon Drive, Beverly Hills, California.
- SHATTUCK, JOHN D.**, Gas Engineer, Chester, Pennsylvania.
- SHIMER, PORTER W.**, Chemist and Metallurgist, Easton, Pennsylvania.
- SHMIDHEISER, W. A.**, Mechanical Engineer, The Bell Telephone Company of Pennsylvania, and for mail, 6017 Pine Street, Philadelphia, Pennsylvania.
- SHOBER, SAMUEL L.**, Special Representative, Union Switch and Signal Company, and for mail, Rittenhouse Club, 1811 Walnut Street, Philadelphia, Pa.

- SHOEMAKER, SAMUEL**, Builder and Real Estate, 1132 Land Title Building, Philadelphia, Pennsylvania.
- SHOEMAKER, THOMAS H.**, (Retired), 120 West Tulpehocken, Germantown, Philadelphia, Pennsylvania.
- SHRADER, J. E.**, Professor of Physics, Drexel Institute, Philadelphia, Pennsylvania.
- SILLCOX, LEWIS K.**, Mechanical and Electrical Engineer, Herrick Road, Box 579, Riverside, Illinois.
- SIMS, Rear Admiral WILLIAM S.**, U. S. N., General Board Naval War College, Newport, Rhode Island.
- SIMSOHN, JULIAN STERN**, Chemist, S. E. corner Broad Street and Girard Avenue, Philadelphia, Pennsylvania.
- SINKLER, JOHN P. B.**, Architect, 412 Otis Building, 112 South 16th Street, Philadelphia, Pennsylvania.
- SKINNER, C. E.**, Engineer, Research Division, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania.
- SKINNER, H. J.**, Vice President, Arthur D. Little, Incorporated, 71 West Chestnut Street, Wakefield, Massachusetts.
- SKINNER, ORVILLE CAMPBELL**, Metallurgical Engineer, Superintendent, Standard Steel Works, Burnham, Pennsylvania.
- SLATER, HOWARD C.**, Mechanical Engineer, Ridley Park, Pennsylvania.
- SMALLING, ELMER, JR.**, Student, 2939 North Camac Street, Philadelphia, Pennsylvania.
- SMITH, A. DW.**, Mining Engineer, 1732 Commercial Trust Building, Philadelphia, Pennsylvania.
- SMITH, ALBERT W.**, Professor of Industrial Chemistry, Case School of Applied Science, and for mail, 11333 Bellflower Road, Cleveland, Ohio.
- SMITH, A. T.**, in care of The Permutit Company, 440 Fourth Avenue, New York City, New York.
- SMITH, AUGUSTUS**, Civil Engineer, Elizabeth, R. F. D. No. 2, New Jersey.
- SMITH, EDWARD W.**, Chemical Engineer, 735 East Penn Street, Germantown, Philadelphia, Pennsylvania.
- SMITH, ELMER A.**, Consulting Electrical Engineer, 596 Columbia Avenue, and for mail, 232 Garden Street, Hoboken, New Jersey.
- SMITH, FRANK W.**, Vice President and General Manager, The United Electric Light and Power Company, 130 East 15th Street, New York City, New York.
- SMITH, HASELTINE**, Insurance Broker, 326 Walnut Street, Philadelphia, Pennsylvania.
- SMITH, HERBERT, S. S.**, Professor of Civil Engineering, 205 Wallace Street, Stroudsburg, Pennsylvania.
- SMITH, IRVING B.**, Chief of Research Department, Leeds and Northrup Company, and for mail, Ambler, Pennsylvania.
- SMITH, J. WALDO**, Chief Engineer, Board of Water Supply, City of New York, Municipal Building, New York City, New York.
- SMITH, N. W.**, Pennsylvania Railroad Company, Room 372, Broad Street Station, Philadelphia, Pennsylvania.
- SMITH, OBERLIN**, Mechanical Engineer and Manufacturer, in care of Ferracute Machine Company, Bridgeton, New Jersey.
- SMITH, P. F., Jr.**, Manager, Altoona Works, Pennsylvania System, Altoona, Pennsylvania.
- SMITH, S. D.**, Machinist, 1616 North Redfield Street, Philadelphia, Pennsylvania.
- SMITH, WALTER B.**, Builder, 6490 Woodbine Avenue, Overbrook, Philadelphia, Pennsylvania.
- SMITH, W. HINCKLE**, Banker, Bryn Mawr, Pennsylvania.
- SMITH, W. LEIGH**, Chemist, The Viscose Company, Box 171, Marcus Hook, Pennsylvania.
- SNELLING, WALTER O.**, Research Chemist, 208 North 5th Street, Allentown, Pennsylvania.
- SNOOK, H. CLYDE**, Electrical Engineer, c/o Western Electric Company, 463 West Street, New York City, New York.
- SNYDER, CLINTON F.**, Chemist, Minersville, Pennsylvania.
- SNYDER, Professor MONROE B.**, Teacher and Astronomer, 111 Grand View Road, Ardmore, Pennsylvania.
- SOUTHALL, JAMES P. C.**, Associate Professor of Physics, Columbia University, New York City, New York.
- SPACKMAN, H. S.**, President, Henry S. Spackman Engineering Company, 2024 Arch Street, Philadelphia, Pennsylvania.
- SPENCER, H. B.**, President, Fruit Growers' Express Company, Munsey Building, Washington, D. C.
- SPENCER, PAUL**, Electrical Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- SPENCER, THOMAS**, Engineer, 3523 Balsam Avenue, Indianapolis, Indiana.
- SPERR, F. W., JR.**, Chief Chemist, The H. Koppers Company, Laboratory, Mellon Institute, Pittsburgh, Pennsylvania.
- SPERRY, ELMER A.**, Engineer, The Sperry Gyroscope Company, Sperry Building, Manhattan Bridge Plaza, Brooklyn, New York.

- SPICER, H. N.**, Metallurgical Engineer, The Architects Building, 101 Park Avenue, New York City, New York.
- SPITZ, SAMUEL**, Inventor, 2244 N. Van Pelt St., Philadelphia, Pennsylvania.
- SPITZGLASS, J. M.**, Mechanical Engineer, 2240 Diversey Boulevard, Chicago, Illinois.
- SPRAGUE, FRANK J.**, Consulting Engineer, President, Sprague Safety Control & Signal Corporation, 421 Canal Street, New York City, New York.
- SPRONG, S. D.**, Electrical Engineer, Atlantic Utilities Corporation, 2 Rector Street, New York City, New York.
- SPROUL, Hon. WM. C.**, Manufacturer, 117 South Sixteenth Street, Philadelphia, Pennsylvania.
- SPRUANCE, W. C.**, Vice President, in Charge of Production Department, E. I. du Pont de Nemours and Company, and for mail, 2507 West 17th Street, Wilmington, Delaware.
- SQUIER, GEORGE OWEN**, Major General, Chief Signal Officer, U. S. Army, K. C. M. G., D. S. C., War Department, Washington, D. C.
- STANFORD, H. R.**, Captain Civil Engineer, (C. E. C.), U. S. N., Bureau of Yards and Docks, Navy Department, Washington, D. C.
- STANLEY, FRANK A.**, Editor, East Auburn, California.
- STEEL, JOSEPH M.**, Building Constructor, 1600 Arch Street, Philadelphia, Pennsylvania.
- STEINMETZ, Dr. CHARLES P.**, Chief Consulting Engineer, General Electric Company, and Professor of Electro-Physics, Union College, and for mail, Wendell Avenue, Schenectady, New York.
- STEINMETZ, JOSEPH ALLISON**, Designer, Janney, Steinmetz and Company, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- STEUER, HENRY J.**, Chemist, 509 South 10th Street, Philadelphia, Pennsylvania.
- STEVENS, JOHN S.**, 9th Street and Montgomery Avenue, Philadelphia, Pennsylvania.
- STEVENSON, Dr. A. R. Jr.**, Electrical Engineer, General Electric Company, 6 Union Street, Schenectady, New York.
- STEVENSON, S. PRICE**, Manufacturer of Cold Storage Doors, 1500 West 4th Street, Chester, Pennsylvania.
- STEWART, FRANK H.**, Dealer in Electrical Supplies, Old Mint Building, Philadelphia, Pennsylvania.
- STEWART, FRANK H.**, 4416 N. Fifteenth St., Philadelphia, Pennsylvania.
- STEWART, RALPH C.**, Attorney-at-Law, Sydenham Building, 1512 Walnut Street, Philadelphia, Pennsylvania.
- STEWART, THOMAS S.**, Physician, 18th and Spruce Streets, Philadelphia, Pennsylvania.
- STILLWELL, L. B.**, Consulting Engineer, 90 West Street, New York City, New York.
- STINE, WILBUR M.**, Author, 3932 Haverford Avenue, Philadelphia, Pennsylvania.
- STOERTZ, HOWARD**, Research Chemist, Electric Storage Battery Company, and for mail, 4741 Rosehill Street, Philadelphia, Pennsylvania.
- STOKES, FRANCIS J.**, Machinery Manufacturer, 17th and Cambria Streets, Philadelphia, Pennsylvania.
- STOKLEY, JAMES, JR.**, Student, 4531 Osage Avenue, Philadelphia, Pennsylvania.
- STONE, C. W.**, Electrical Engineer, General Electric Company, Schenectady, New York.
- STONE, JOHN STONE**, Consulting Electrical Engineer, 3942 Alameda Street, San Diego, California.
- STOTESBURY, E. T.**, Banker, Chestnut and Fifth Streets, Philadelphia, Pennsylvania.
- STOUGHTON, A. B.**, Attorney-at-Law, 1506 Land Title Building, Philadelphia, Pennsylvania.
- STOUT, ORIN C.**, Industrial Engineer, 207 Commerce Building, Columbus, Ohio.
- STRADLING, Dr. G. F.**, Teacher, Principal Northeast High School, and for mail, 5120 Newhall Street, Germantown, Philadelphia, Pennsylvania.
- STRONG, WILLIAM WALKER**, Consulting Physicist, 500 South York Street, Mechanicsburg, Cumberland County, Pennsylvania.
- STROUD, EDWARD A.**, Florist, 508 South 41st Street, Philadelphia, Pennsylvania.
- STUTZ, ERNEST**, Representative for Foreign Patents, 1705 Hope Street, South Pasadena, California.
- STYRI, Dr. HAAKON**, Chief Chemist, S. H. F. Research Laboratory, Front Street & Erie Avenue, Philadelphia, Pennsylvania.
- SUCZEK, ROBERT**, Mechanical Engineer, Maly Ujezd 3, Melnik 2, Czecho-Slovakia, Europe.
- SULZNER, CHARLES F.**, (Retired), 131 N. E. Second Street, Miami, Florida.
- SUPPLEE, WM. H.**, Factory Manager, 211 South 12th Street, Philadelphia, Pennsylvania.
- SUTTON, FRANK W.**, Industrial Engineer, Charles E. Bedaux Company, 4500 Euclid Avenue, Cleveland, Ohio.
- SUYDAM, V. A.**, Professor of Physics and Applied Mathematics, 1126 Porter Avenue, Beloit, Wisconsin.
- SWENSON, MAGNUS**, President and Treasurer, Southern Wisconsin Power Company, Madison, Wisconsin.
- SYKES, JOHN P.**, The Baldwin Locomotive Works, Broad and Spring Garden Streets, Philadelphia, Pennsylvania.

- SYMONS, JOHN E., Mechanical Engineer, Superintendent, Lubrication Division, The Texas Company, 17 Battery Place, New York City, New York.
- SYMONS, WILSON E., Consulting Engineer, 108 West 43rd Street, New York City, New York.
- SYNNESTVEDT, ARTHUR, Student, Bryn Athyn, Pennsylvania.
- TABER, GEORGE H., Vice President, Gult Refining Company, P. O. Box 1214, Pittsburgh, Pennsylvania.
- TAGGART, WALTER T., Professor of Chemistry, University of Pennsylvania, Philadelphia, Pennsylvania.
- TAIT, EDWARD H., Superintendent, 401 Brighter Apartments, Second & Penn Streets, Reading, Pennsylvania.
- TAIT, F. M., Callahan Bank Building, Dayton, Ohio.
- TALBOT, H. P., Professor of Inorganic Chemistry, Massachusetts Institute of Technology, Boston, Massachusetts.
- TANBERG, Dr. ARTHUR P., Chemist, E. I. du Pont de Nemours & Company, Henry Clay, Delaware.
- TATE, ALFRED O., President, Tate Electrolytic Textile Processes, Incorporated, 32 St. James Street, London, S. W. 1., England.
- TATNALL, Dr. ROBERT R., Research Engineer, J. E. Rhoads and Sons, Wilmington, Delaware.
- TAWS, LOUIS, (Retired), 6654 Lincoln Drive, Germantown, Philadelphia, Pennsylvania.
- TAYLOR, DAVID WATSON, Rear Admiral, U. S. N., 1813 19th Street N. W., Washington, D. C.
- TAYLOR, H., BIRCHARD, Vice President, Wm. Cramp & Sons Ship & Engine Building Company, Richmond and Norris Streets, Philadelphia, Pennsylvania.
- TAYLOR, HOLLINSHEAD N., Tinplate Manufacturer, 300 Chestnut Street, Philadelphia, Pennsylvania.
- TAYLOR, LOWNDES, Address unknown.
- TEEPLE, Dr. JOHN E., Consulting Chemist and Chemical Engineer, 50 East 41st Street, New York City, New York.
- TEMPLE, EDWARD B., Swarthmore, Pennsylvania.
- THAMM, CHARLES G. A., Clerk, 847 Levick Street, Lawndale, Philadelphia, Pennsylvania.
- THOMAS, ARTHUR H., Laboratory Appliances, West Washington Square, Philadelphia, Pennsylvania.
- THOMAS, C. C., Professor of Mechanical Engineering, 1111 Hollingsworth Building, Los Angeles, California.
- THOMAS, L. E., President, Reading Iron Company, Reading, Pennsylvania.
- THOMPSON, ARTHUR W., President, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.
- THOMPSON, HUGH L., Consulting Engineer, Waterbury, Connecticut.
- THOMPSON, PAUL, N. W. cor. Broad and Arch Streets, Philadelphia, Pennsylvania.
- THOMSON, ELIHU, Professor, Electrical Engineer, 22 Monument Avenue, Swampscott, Massachusetts.
- THOMSON, Sir JOSEPH J., Trinity College, Cambridge, England.
- THORNE, WILLIAM H., Mechanical Engineer, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- THWING, Dr. CHAS. BURTON, 3339 Lancaster Avenue, Philadelphia, Pennsylvania.
- TIDDY, WILLIAM, Chief Chemist, Rainey-Wood Coke Company, Swedeland, Pennsylvania.
- TIEMANN, HUGH P., Metallurgical Engineer, Carnegie Steel Company, Pittsburgh, Pennsylvania.
- TILGHMAN, B. C., "The Hermitage" near Centreville, Queen Ann County, Maryland.
- TITZEL, R. JOHN, Gas Engineer, Hamilton Apartments, Norristown, Pennsylvania.
- TOCH, MAXIMILIAN, Paint Manufacturer, Director, Research Laboratory, Toch Brothers, 320 Fifth Avenue, New York City, New York.
- TORCHIO, PHILIP, Chief Electrical Engineer, The New York Edison Company, Irving Place and 15th Street, New York City, New York.
- TOULMIN, H. A., JR., Patent Attorney, 901 Schwind Building, Dayton, Ohio.
- TOWNE, HENRY R., Mechanical Engineer, 420 Park Avenue, New York City, New York.
- TOWNEND, R. V., Research Chemist, Victor Talking Machine Company, Camden, New Jersey.
- TOWNSEND, JOHN SEALY, Professor of Physics, New College, Oxford, England.
- TOWNSEND, J. W., 825 Montgomery Avenue, Bryn Mawr, Pennsylvania.
- TRAUTWINE, JOHN C., Jr., Civil Engineer, 257 South 4th Street, Philadelphia, Pennsylvania.
- TRAUTWINE, JOHN C., 3rd., Civil Engineer, Box 403, Rutledge, Pennsylvania.
- TRENCH, W. W., The General Electric Company, Schenectady, New York.
- TREXLER, HARRY C., Colonel, President, Lehigh Portland Cement Company, Allentown, Pennsylvania.
- TROWBRIDGE, Professor AUGUSTUS, Teacher, Princeton University, Princeton, New Jersey.

- TRUE, RODNEY H., Professor of Botany, University of Pennsylvania, Philadelphia, Pennsylvania.
- TRUEMAN, WILLIAM H., Dentist, 47 High Street, Germantown, Philadelphia, Pennsylvania.
- TUTTLE, E. B., Engineer of Transmission and Protection, Bell Telephone Company of Pennsylvania, 261 North Broad Street, Philadelphia, Pennsylvania.
- TUTTLE, WM. C., Manager of Trust Investments, Girard Trust Company, Philadelphia, Pennsylvania.
- TUTWILER, C. C., Consulting Gas Chemist, West Conshohocken, Pennsylvania.
- TWINING, WM. STANTON, Civil Engineer, 119 Harvey Street, Germantown, Philadelphia, Pennsylvania.
- TYSON, H. P., Collegeville, Pennsylvania.
- UEHLING, E. A., Mechanical Engineer, 3226 McKinley Building, Milwaukee, Wisconsin.
- ULMER, CARL D., Chemist, Minnesota By-Product Coke Company, 1000 Hamline Avenue, St. Paul, Minnesota.
- UNDERWOOD, FREDERICK D., President, Erie Railroad Company, 50 Church Street, New York City, New York.
- UNWIN, WILLIAM CAWTHORNE, Civil Engineer, Palace Gate Mansions, Kensington, London, England.
- VAIL, JAMES G., Chief Chemist, Philadelphia Quartz Company, 121 South 3rd Street, Philadelphia, Pennsylvania.
- VALASEK, J., Physicist, 898 18th Avenue, S. E., Minneapolis, Minnesota.
- VAN DER LINGEN, J. STEPHEN, Lecturer, Department of Applied Mathematics, University of Cape Town, South Africa.
- VAN DEVENTER, CHRISTOPHER, Consulting Engineer, 438 First National Bank Building, Chicago, Illinois.
- VAN DEVENTER, H. R., Engineer and Patent Attorney, Dubilier Condenser and Radio Corporation, 48 West Fourth Street, New York City, New York.
- VAN DYKE, J. W., President, The Atlantic Refining Company, and for mail, The Wellington, Philadelphia, Pennsylvania.
- VAN TRUMP, S. N., Civil Engineer, Water Department, Wilmington, Delaware.
- VAUCLAIN, S. M., President, The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- VAUGHAN, H. H., Engineer, 20 MacGregor Street, Montreal, Quebec, Canada.
- VAUGHEN, F. G., Manager, Meter Department, General Electric Company, Schenectady, New York.
- VAUX, GEORGE, JR., Attorney-at-Law, Gulf Road, Bryn Mawr, Pennsylvania.
- VEEDER, CURTIS H., Manufacturer, Veeder Manufacturing Company, Hartford, Connecticut.
- VIAL, ETHAN, 7474 Lower River Road, Fernbank, Cincinnati, Ohio.
- VOGLESON, JOHN A., Civil Engineer, 8009 Crefeldt Street, Philadelphia, Pennsylvania.
- VREELAND, FREDERICK R., Research Engineer, 90 West Street, New York City, New York.
- WADDELL, J. A. L., Consulting Engineer, 35 Nassau Street, New York City, New York.
- WADLEIGH, F. R., Federal Fuel Distributor, 718 18th Street, Washington, D. C.
- WADSWORTH, F. L. O., Consulting and Advisory Engineer, P. O. Box 268, East Liberty Station, Pittsburgh, Pennsylvania.
- WAGNER, FRED H., Chief Engineer, The Bartlett Hayward Company, and for mail, Lombardy Apartments, 39th Street and Stony Run Lane, Baltimore, Maryland.
- WAGNER, HERBERT A., President, Consolidated Gas, Electric Light and Power Company, Lexington and Liberty Streets, Baltimore, Maryland.
- WAGNER, JOHN, "Four Oaks," School House Lane, Germantown, Philadelphia, Pennsylvania.
- WAGNER, SAMUEL T., Chief Engineer, Philadelphia and Reading Railway Company, and for mail, School House Lane Germantown, Philadelphia, Pennsylvania.
- WAGNER, TOBIAS, E. Willow Grove Avenue, Chestnut Hill, Philadelphia, Pennsylvania.
- WALDRON, WILLIAM H., Manufacturer of Machinery, John Waldron Company, New Brunswick, New Jersey.
- WALKER, J. W., Manufacturer, Devon, Pennsylvania.
- WALLER, ALFRED E., Electrical Engineer, Lawrence Park, Bronxville, New York.
- WALLERSTEIN, LEO, Chemist, 171 Madison Avenue, New York City, New York.
- WALLIS, J. T., Chief of Motive Power, Pennsylvania System, Broad Street Station, Philadelphia, Pennsylvania.
- WALTON, HORACE, Insurance, 416-420 Walnut Street, Philadelphia, Pennsylvania.
- WARD, ALGER L., Chemist, 4934 N. Front Street, Philadelphia, Pennsylvania.
- WARDEN, WILLIAM G., 1012 Witherspoon Building, Philadelphia, Pennsylvania.
- WARNER, WM. R., JR., (Retired) "Sulgrave," Malvern, P. O., Chester County, Pennsylvania.
- WARNOCK, JAMES, JR., Bookkeeper, 333 Chestnut Street, Philadelphia, Pennsylvania.
- WARRINER, S. D., President Lehigh Coal and Navigation Company, 437 Chestnut Street, Philadelphia, Pennsylvania.
- WARWICK, J. F., Electrical Engineer, 61 Crew Street, Atlanta, Georgia.

- WATSON, JAMES, Steam Specialty Manufacturer, 146 North Seventh Street, Philadelphia, Pennsylvania.
- WEBSTER, ALBERT L., Consulting Sanitary Engineer, 112 E. 40th Street, New York City, New York.
- WEBSTER, GEORGE S., Civil Engineer, 4900 Penn Street, Frankford, Philadelphia, Pennsylvania.
- WEBSTER, WM. R., Consulting and Inspecting Engineer, 413 Walnut Street, Philadelphia, Pennsylvania.
- WEEKS, EDWIN R., Consulting Engineer, 505 New Nelson Building, Kansas City, Missouri.
- WEIDLEIN, EDWARD R., Chemical Engineer, Director of Mellon Institute of Industrial Research, Pittsburgh, Pennsylvania.
- WEINBERG, SOLOMON, Chemical Engineer, Research Laboratory, 2027 Arch Street, and for mail, Sunderland House, 35th Street and Powelton Avenue, Philadelphia, Pennsylvania.
- WEISS, J. M., 50 East 41st Street, New York City, New York.
- WELLS, G. A., 11 West 8th Street, New York City, New York.
- WELLS, W. F., Vice President, Edison Electric Illuminating Company, 360 Pearl Street, Brooklyn, New York.
- WELSH, FRANCIS RALSTON, Investments, Devon, Pennsylvania.
- WELTZ, EARL H., Chemist, E. I. du Pont de Nemours & Company, 122 Broadway, Carney's Point, New Jersey.
- WESTON, Dr. EDWARD, President, Weston Electrical Instrument Company, Waverly Park, Newark, New Jersey.
- WESTON, F. W., Manufacturer, Wynnewood, Pennsylvania.
- WETHERILL, ROBERT, Engine and Machine Work Manufacturer, Chester, Pennsylvania.
- WETHERILL, S. P., Manufacturer, Room 600, Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- WETHERILL, W. CHATTIN, Department of Mechanical Engineering, University of Pennsylvania, Philadelphia, Pennsylvania.
- WEYL, CHARLES N., 6506 Lincoln Drive, Germantown, Philadelphia, Pennsylvania.
- WHARTON, HENRY, Chestnut Hill, Philadelphia, Pennsylvania.
- WHITAKER, JAMES L., Cotton Manufacturer, Cedar Grove, Olney, Philadelphia, Pennsylvania.
- WHITE, A. RAYMOND, Research Physicist, H. M. Bylesby and Company, 12031 Wallace Street, Chicago, Illinois.
- WHITE, J. ATWOOD, Paper Machinery Manufacturer, 15th Street and Lehigh Avenue, Philadelphia, Pennsylvania.
- WHITE, W. M., Hydraulic Engineer, Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin.
- WHITNEY, ASA W., Metallurgist, in care of Enterprise Foundry and Machine Works, Bristol, Tennessee.
- WHITNEY, CHARLES H., Whitney-MacDonald Company, Tioga and Memphis Streets, Philadelphia, Pennsylvania.
- WHITNEY, E. R., President, Commercial Truck Company, Hunting Park and Rising Sun Avenue, Philadelphia, Pennsylvania.
- WHITNEY, FRANK E., Mechanical Engineer, Commercial Truck Company, Hunting Park and Rising Sun Avenues, Philadelphia, Pennsylvania.
- WHITNEY, LOUIS B., Manager, Alpha Portland Cement Company, 428 Oliver Building, Pittsburgh, Pennsylvania.
- WHYTE, F. M., Vice President, Hutchins Car Roofing Company, New York City, and for mail, 14 Benedict Avenue, Tarrytown, New York.
- WIDDICOMBE, Major R. A., Engineer, 4639 Beacon Street, Chicago, Illinois.
- WIDMYER, JOHN H., Metallographist, Lancaster Steel Products Corporation, Lancaster, Pennsylvania.
- WIEDERSHEIM, J. A., Patent Attorney and Mechanical Expert, 1232 Chestnut Street, Philadelphia, Pennsylvania.
- WIEGAND, JOHN, Salesman, 2020 North Marshall Street, Philadelphia, Pennsylvania.
- WILBUR, W. A., Banker, South Bethlehem, Pennsylvania.
- WILEY, Dr. H. W., Chemist, Room 1120, Woodward Building, Washington, D. C.
- WILKIN, JOHN T., President and Engineer, The Connersville Blower Company, and for mail, 905 Grand Avenue, Connersville, Indiana.
- WILLCOX, JAMES M., Wawa, Delaware County, Pennsylvania.
- WILLCOX, W. F., Darling Post Office, Delaware County, Pennsylvania.
- WILLE, H. V., Assistant, Vice President, The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- WILLIAMS, CHARLES A., Chemist, The Pure Oil Company, Marcus Hook, Pennsylvania, and for mail, 917 Madison Street, Chester, Pennsylvania.
- WILLIAMS, E. D., Attorney-at-Law, 560 Drexel Building, Philadelphia, Pennsylvania.
- WILLIAMS, HENRY S., President, Williams, Brown and Earle, Incorporated, 918 Chestnut Street, Philadelphia, Pennsylvania.
- WILLIAMS, IRA JEWELL, Attorney-at-Law, 1005 Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.

- WILLIAMS, Dr. WILLIAM J.**, Chemist, 1208 Haworth Street, Frankford, Philadelphia, Pennsylvania.
- WILIAMSON, J. D., JR.**, Vice President, American Engineering Company, Latham Park, Oak Lane P. O., Philadelphia, Pennsylvania.
- WILSON, ARTHUR M.**, General Insurance, 706 Stock Exchange Building, Philadelphia, Pennsylvania.
- WILSON, H. A.**, Coronado Apartments, 22nd and Chestnut Streets, Philadelphia, Pennsylvania.
- WILSON, H. D.**, Coronado Apartments, 22nd and Chestnut Streets, Philadelphia, Pennsylvania.
- WILSON, HENRY W.**, Civil Engineer, 909 Clinton Street, Philadelphia, Pennsylvania.
- WILSON, J. CLIFFORD**, President and Treasurer, I. S. Wilson and Son, Incorporated, Room 205, 1509 Arch Street, Philadelphia, Pennsylvania.
- WILSON, J. HUNT**, Professor of Chemistry, Lafayette College, 531 Cattell Street, Easton, Pennsylvania.
- WILSON, J. L.**, 608 Chestnut Street, Philadelphia, Pennsylvania.
- WILSON, JOHN S.**, Inspector, 124 South Eufaw Street, Baltimore, Maryland.
- WILSON, Dr. WILLIAM**, Engineer, American Telephone and Telegraph Company, 195 Broadway, New York City, and for mail, 22 Beach Place, Maplewood, New Jersey.
- WIRT, CHARLES**, President and Engineer, Wirt Company, and for mail, 508 East Washington Lane, Germantown, Philadelphia, Pennsylvania.
- WOLF, DANIEL DORSEY**, Treasurer, C. C. Kampton & Son, 527 Vine Street, Philadelphia, Pennsylvania.
- WOLF, JOHN JACOB**, 927 North Fifth Street, Philadelphia, Pennsylvania.
- WOOD, ALAN**, 3rd, Mechanical Engineer, Flat Rock, North Carolina.
- WOOD, ALBERT C.**, Consulting Mechanical Engineer, Stock Exchange Building, Philadelphia, Pennsylvania.
- WOOD, BIDDLE**, Iron Manufacturer, Conshohocken, Pennsylvania.
- WOOD, E. R., JR.**, Mechanical Engineer, 409 Chestnut Street, Philadelphia, Pennsylvania.
- WOOD, F. W.**, President, Maryland Steel Company, and for mail, Keyworth Avenue, Baltimore, Maryland.
- WOOD, ROBERT L.**, Civil Engineer, B. H. Dyer Company, Manufacturers, 1323 Widener Building, Philadelphia, Pennsylvania.
- WOOD, WALTER**, Manufacturer, 400 Chestnut Street, Philadelphia, Pennsylvania.
- WOODBIDGE, J. LESTER**, Electrical Engineer, 19th Street and Allegheny Avenue, Philadelphia, Pennsylvania.
- WOODBURY, C. A.**, Director, Eastern Laboratory, E. I. du Pont de Nemours Company, Drawer 424, Chester, Pennsylvania.
- WOODHOUSE, HENRY**, Editor, Foster Building, Madison Avenue and 40th Street, New York City, New York.
- WOODROFFE, G. H.**, Mechanical and Metallurgical Engineer, Parkesburg, Chester County, Pennsylvania.
- WOODWARD, GEORGE**, Physician, 708 North American Building, Philadelphia, Pennsylvania.
- WOOLMAN, EDWARD**, Mechanical Engineer, N. W. cor. Buck and Panmure Roads, Haverford, Pennsylvania.
- WORFELL, HOWARD SELLERS**, Engineer, 100 East Montgomery Avenue, Ardmore, Pennsylvania.
- WRIGHT, FRANK L.**, Factory Metallurgist, Atlas Ball Company, 4th Street and Glenwood Avenue, Philadelphia, Pennsylvania.
- WRIGHT, JAMES A.**, Wright-Fisher Engineering Company, 600 McGill Building, Montreal, Quebec, Canada.
- WRIGHT, ORVILLE**, Aeronautical Research Engineer, 15 North Broadway, Dayton, Ohio.
- WRIGHT, ROY V.**, Editor, 398 North Walnut Street, East Orange, New Jersey.
- WRIGHT, WINTHROP R.**, Professor of Physics, Swarthmore College, and for mail, 4 Whittier Place, Swarthmore, Pennsylvania.
- WYATT, JAMES H.**, Electrical Engineer, Cutter Electric and Manufacturing Company, 19th and Hamilton Streets, Philadelphia, Pennsylvania.
- YARNALL, D. ROBERT**, Mechanical Engineer, Chestnut Hill, Philadelphia, Pennsylvania.
- YEOMANS, LUCIEN I.**, Industrial Engineer, Vice President, Amalgamated Machinery Corporation, Room 962, Monadnock Block, 53 West Jackson Blvd., Chicago, Illinois.
- YORK, H. W.**, Consulting Engineer, 120 Broadway, New York City, New York.
- YORKE, GEORGE M.**, Engineer, 70 Irving Place, New York City, New York.
- YOUNG, J. BERTRAM**, Chemist, Philadelphia and Reading Railway Company, Reading, Pennsylvania.
- ZEHNDEK, CHARLES H.**, Coal and Iron Merchant, Room 3018, 120 Broadway, New York City, New York.

ZILEN, VICTOR W., Mechanical Engineer, Route No. 1, Box 139, Chattanooga, Tennessee.
ZIMMERMANN, JOHN E., Mechanical Engineer, Member of Firm, Day and Zimmermann, 1600 Walnut Street, Philadelphia, Pennsylvania.

MEMBERS WHOSE ADDRESSES ARE UNKNOWN

ANDERSON, GEORGE L. (Honorary).
BYRD, JOHN.
HALE, HENRY S.
TAYLOR, LOWNDES

- WILLIAMS, Dr. WILLIAM J.**, Chemist, 1208 Haworth Street, Frankford, Philadelphia, Pennsylvania.
- WILLIAMSON, J. D., JR.**, Vice President, American Engineering Company, Latham Park, Oak Lane P. O., Philadelphia, Pennsylvania.
- WILSON, ARTHUR M.**, General Insurance, 706 Stock Exchange Building, Philadelphia, Pennsylvania.
- WILSON, H. A.**, Coronado Apartments, 22nd and Chestnut Streets, Philadelphia, Pennsylvania.
- WILSON, H. D.**, Coronado Apartments, 22nd and Chestnut Streets, Philadelphia, Pennsylvania.
- WILSON, HENRY W.**, Civil Engineer, 909 Clinton Street, Philadelphia, Pennsylvania.
- WILSON, J. CLIFFORD**, President and Treasurer, I. S. Wilson and Son, Incorporated, Room 205, 1509 Arch Street, Philadelphia, Pennsylvania.
- WILSON, J. HUNT**, Professor of Chemistry, Lafayette College, 531 Cattell Street, Easton, Pennsylvania.
- WILSON, J. L.**, 608 Chestnut Street, Philadelphia, Pennsylvania.
- WILSON, JOHN S.**, Inspector, 124 South Eufaw Street, Baltimore, Maryland.
- WILSON, Dr. WILLIAM**, Engineer, American Telephone and Telegraph Company, 195 Broadway, New York City, and for mail, 22 Beach Place, Maplewood, New Jersey.
- WIRT, CHARLES**, President and Engineer, Wirt Company, and for mail, 508 East Washington Lane, Germantown, Philadelphia, Pennsylvania.
- WOLF, DANIEL DORSEY**, Treasurer, C. C. Kampton & Son, 527 Vine Street, Philadelphia, Pennsylvania.
- WOLF, JOHN JACOB**, 927 North Fifth Street, Philadelphia, Pennsylvania.
- WOOD, ALAN**, 3rd. Mechanical Engineer, Flat Rock, North Carolina.
- WOOD, ALBERT C.**, Consulting Mechanical Engineer, Stock Exchange Building, Philadelphia, Pennsylvania.
- WOOD, BIDDLE**, Iron Manufacturer, Conshohocken, Pennsylvania.
- WOOD, E. R., JR.**, Mechanical Engineer, 409 Chestnut Street, Philadelphia, Pennsylvania.
- WOOD, F. W.**, President, Maryland Steel Company, and for mail, Keyworth Avenue, Baltimore, Maryland.
- WOOD, ROBERT L.**, Civil Engineer, B. H. Dyer Company, Manufacturers, 1323 Widener Building, Philadelphia, Pennsylvania.
- WOOD, WALTER**, Manufacturer, 400 Chestnut Street, Philadelphia, Pennsylvania.
- WOODBIDGE, J. LESTER**, Electrical Engineer, 19th Street and Allegheny Avenue, Philadelphia, Pennsylvania.
- WOODBURY, C. A.**, Director, Eastern Laboratory, E. I. du Pont de Nemours Company, Drawer 424, Chester, Pennsylvania.
- WOODHOUSE, HENRY**, Editor, Foster Building, Madison Avenue and 40th Street, New York City, New York.
- WOODROFFE, G. H.**, Mechanical and Metallurgical Engineer, Parkesburg, Chester County, Pennsylvania.
- WOODWARD, GEORGE**, Physician, 708 North American Building, Philadelphia, Pennsylvania.
- WOOLMAN, EDWARD**, Mechanical Engineer, N. W. cor. Buck and Panmure Roads, Haverford, Pennsylvania.
- WORRELL, HOWARD SELLERS**, Engineer, 100 East Montgomery Avenue, Ardmore, Pennsylvania.
- WRIGHT, FRANK L.**, Factory Metallurgist, Atlas Ball Company, 4th Street and Glenwood Avenue, Philadelphia, Pennsylvania.
- WRIGHT, JAMES A.**, Wright-Fisher Engineering Company, 600 McGill Building, Montreal, Quebec, Canada.
- WRIGHT, ORVILLE**, Aeronautical Research Engineer, 15 North Broadway, Dayton, Ohio.
- WRIGHT, ROY V.**, Editor, 398 North Walnut Street, East Orange, New Jersey.
- WRIGHT, WINTHROP R.**, Professor of Physics, Swarthmore College, and for mail, 4 Whittier Place, Swarthmore, Pennsylvania.
- WYATT, JAMES H.**, Electrical Engineer, Cutter Electric and Manufacturing Company, 19th and Hamilton Streets, Philadelphia, Pennsylvania.
- YARNALL, D. ROBERT**, Mechanical Engineer, Chestnut Hill, Philadelphia, Pennsylvania.
- YEOMANS, LUCIEN I.**, Industrial Engineer, Vice President, Amalgamated Machinery Corporation, Room 962, Monadnock Block, 53 West Jackson Blvd., Chicago, Illinois.
- YORK, H. W.**, Consulting Engineer, 120 Broadway, New York City, New York.
- YORKE, GEORGE M.**, Engineer, 70 Irving Place, New York City, New York.
- YOUNG, J. BERTRAM**, Chemist, Philadelphia and Reading Railway Company, Reading, Pennsylvania.
- ZEHNDER, CHARLES H.**, Coal and Iron Merchant, Room 3018, 120 Broadway, New York City, New York.

ZILEN, VICTOR W., Mechanical Engineer, Route No. 1, Box 139, Chattanooga, Tennessee.

ZIMMERMANN, JOHN E., Mechanical Engineer, Member of Firm, Day and Zimmermann, 1600 Walnut Street, Philadelphia, Pennsylvania.

MEMBERS WHOSE ADDRESSES ARE UNKNOWN

ANDERSON, GEORGE L. (Honorary).

BYRD, JOHN.

HALE, HENRY S.

TAYLOR, LOWNDES

Important New Scientific Publications

- PETROLEUM.** By Sir Boverton Redwood, Bart. New Edition, Revised and Reset. In Three Volumes with Plates, Numerous Illustrations in the Text and Many New Maps Especially Prepared for this Edition. 1353 Pages. \$39.00
- HANDBOOK OF INDUSTRIAL OIL ENGINEERING.** By John Rome Battle, B.S., M.E. 1100 Pages, Thumb Index, 350 Illustrations, 40 Curves, 100 Useful Tables, 9 Color Plates, 9 Charts, Large Octavo, Cloth. An invaluable reference book for oil engineers. 10.00
- A SHORT HANDBOOK OF OIL ANALYSIS.** By Augustus H. Gill, S.B., Ph.D. Tenth Edition, Revised (1922). The standard short handbook for chemists and engineers. Illustrated, Diagrams, Tables, 12mo. 2.50
- INDUSTRIAL ORGANIC CHEMISTRY.** By Samuel P. Sadtler, Ph.D., LL.D., and Louis J. Matos, Ph.D. Fifth Edition, Revised, Enlarged, and in Part Rewritten. Adapted for the Use of Manufacturers, Chemists, and all Interested in the Utilization of Organic Materials in the Industrial Arts. 8.00
- ORGANIC CHEMISTRY.** By W. H. Perkin, Ph.D., and F. Stanley Kipping, Ph.D. New Edition (1922). Completely Revised. 681 Plus xx Pages. Illustrated. 2.50
- AUTOMATIC PUMPING.** By W. Walker Fyfe. Numerous Illustrations, Diagrams and Tables with Notes on Water Analysis and Filtration. 3.00
- A TEXT-BOOK OF INORGANIC CHEMISTRY.** Volume IX, Part Two. Iron. By J. Newton Friend, D.Sc., Ph.D., F.I.C. Frontispiece and 8 Illustrations. 7.50
- COKE-OVEN AND BY-PRODUCT WORKS CHEMISTRY.** By Thomas Biddulph-Smith. 62 Illustrations and 7 Folding Plates. 196 Pages. 7.00
- SOME MICROCHEMICAL TESTS FOR ALKALOIDS.** By Charles H. Stephenson. Illustrated with 27 Plates including 162 Photomicrographs of Tests. 4.00
- ANIMAL AND VEGETABLE FIXED OILS, FATS, BUTTERS AND WAXES.** By C. R. Adler Wright. 3 Plates and 185 Illustrations. New Edition, Revised and Enlarged. 20.00
- THE CLAYWORKER'S HANDBOOK.** By Alfred B. Searle. New Illustrations. New Edition, Revised and Rewritten. 6.50
- CYANIDING GOLD AND SILVER ORES.** By H. F. Julian and Edgar Smart. Numerous Illustrations, Plates and Maps. New Edition, Revised. 12.50
- OIL FUEL.** By Edward Butler. Numerous Illustrations. New Edition, Revised and Enlarged. 5.00
- PETROLEUM REFINING.** By Andrew Campbell. Illustrated. New Edition, Revised. 8.50
-

J. B. LIPPINCOTT COMPANY

PHILADELPHIA

LONDON

CHICAGO

MONTREAL

"THE TRUST COMPANY AND THE INDIVIDUAL"

A booklet answering specific questions on the fundamentals of Trust relationships. Copies will be mailed on request.

TRUST DEPARTMENT

Capital
\$5,200,000
Surplus
\$16,000,000



Funds Held
In Trust
More Than
\$300,000,000

FIDELITY TRUST CO.

325 Chestnut St.
1431 Chestnut St.

6324 Woodland Ave.,
West Philadelphia

JOURNAL OF THE FRANKLIN INSTITUTE

The Institute has for sale a limited number of copies of the earlier issues and is prepared to supply orders at the following rates:

| | |
|---|---|
| 1824 to 1839, incl... Prices on application | 1880 to 1899, incl... \$1.00 per number |
| 1840 to 1859, incl... \$2.00 per number | 1900 to 1909, incl... .75 per number |
| 1860 to 1879, incl... 1.50 per number | 1910 to 1920, incl... .50 per number |
| | 1921 and later..... .60 per number |

Members may obtain bound volumes of the current issue of the Journal by returning their unbound copies in good condition with \$1.95.

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

PAMPHLET REPRINTS OF LECTURES AND OTHER CONTRIBUTIONS

A limited number of reprints of the various papers which appear in the Journal are now on sale. They may be purchased at twenty-five cents per copy.

Complete pamphlets of articles appearing in two or more instalments will be charged for at the rate of twenty-five cents per issue.

Orders and inquiries should be addressed to

THE FRANKLIN INSTITUTE

PHILADELPHIA

AMERICAN PLATINUM WARE

Standard Ware—Made of our specially refined platinum.
Meets the most exacting demands of the laboratory worker.

Complete Catalogue No. 15 on request

AMERICAN PLATINUM WORKS
NEWARK, N. J.

Welsbach Company

GLOUCESTER, N. J.

Manufacturers of

THORIUM NITRATE

and other rare earth chemicals,
including SALTS of

| | | | |
|-----------|-----------|-------------|----------|
| Cerium | Lanthanum | Neodymium | Yttrium |
| Zirconium | Beryllium | Mesothorium | Samarium |

Welsbach Lights & Mantles

COLORS

Acid—Mordant—Basic—Direct—Sulphur

Intermediates
Hydrosulphites

Sizing Materials
Cotton Finishes

Turkey Red Oils
Soluble Oils

OFFERED BY

H. A. METZ & CO., Inc.

Boston
Philadelphia
Chicago

122 Hudson Street
NEW YORK

Charlotte
San Francisco
Providence

THE JOHN T. DYER QUARRY CO.

BUSINESS ESTABLISHED 1891

BIRDSBORO TRAPPE ROCK

HARRISON BUILDING

PHILADELPHIA

ALAN WOOD IRON & STEEL CO.



PHILADELPHIA

PIG IRON

BILLETS, BLOOMS AND SLABS

SHEARED PLATES

ROLLED STEEL FLOOR PLATES

BLUE ANNEALED STEEL SHEETS

Electrical Testing Laboratories

Electrical and Mechanical Laboratories

Tests of Electrical Machinery, Apparatus and Supplies.
Materials of Construction. Coal, paper, etc. Inspection
of Material and Apparatus at Manufactories.

80th St. and East End Ave.

New York

HENRY BOWER
Chemical Manufacturing Company
YELLOW PRUSSIATES

**SODIUM
CALCIUM**

PHILADELPHIA

PENNSYLVANIA

JOHN J. GRIFFIN & CO.

Manufacturers of

GAS METERS
AND APPARATUS

Repairing Promptly Attended to

No. 1513 to 1521 Race Street

PHILADELPHIA

THE PHYSICS OF THE AIR

By

WILLIAM J. HUMPHREYS, Ph.D.

Professor of Meteorological Physics
United States Weather Bureau

A rational and deductive treatise on the
physics of the atmosphere. Of great value
to meteorologists, physicists and the aviator.

678 Pages, Illustrations, Index, 8vo.

Price, \$5.00

Carriage extra.

Address orders and inquiries to

THE FRANKLIN INSTITUTE
PHILADELPHIA, U.S.A.



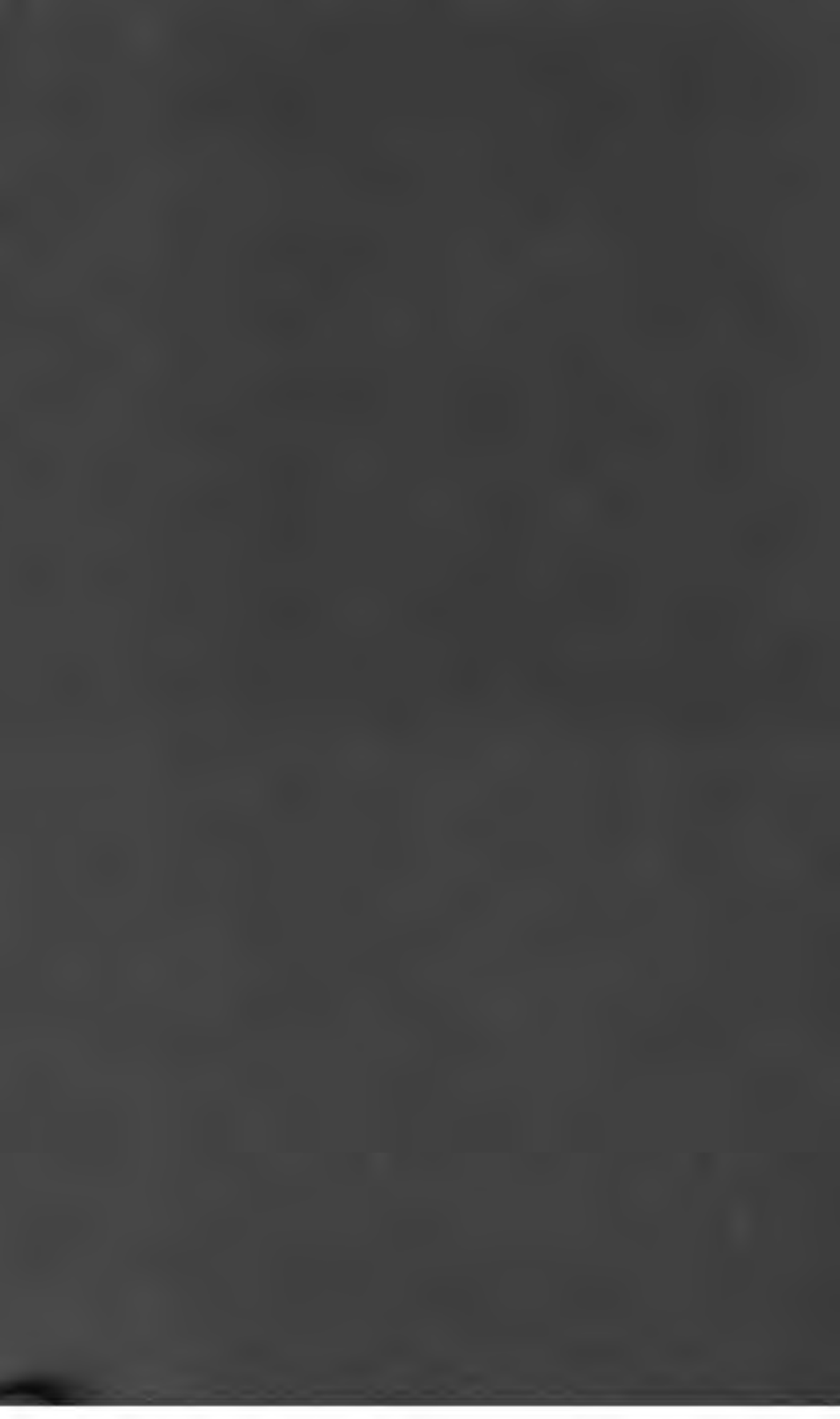
THE FRANKLIN INSTITUTE
OF THE
STATE OF PENNSYLVANIA

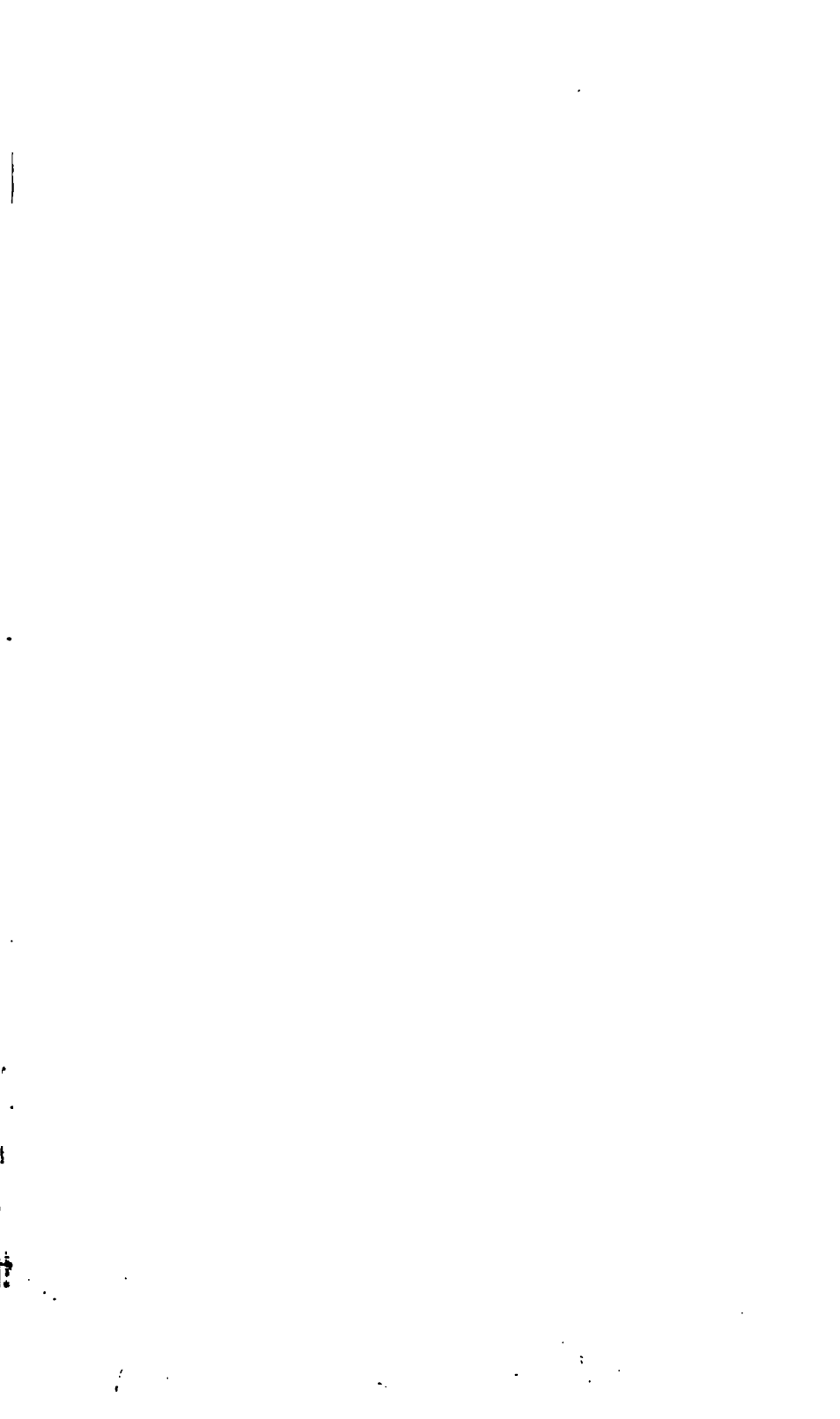
Transcription
Library

TRANSCRIPTION LIBRARY

59344
1924-25
YEAR BOOK
1924-1925









THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

FOUNDED 1824

Year Book
1924-1925

PHILADELPHIA

HALL OF THE INSTITUTE

15 SOUTH SEVENTH STREET

April 1, 1925



THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

FOUNDED 1824

Year Book
1924-1925

PHILADELPHIA

HALL OF THE INSTITUTE

15 SOUTH SEVENTH STREET

April 1, 1925

**Transportation
Library**

T
I

.F834-Y
1924-25

TELEPHONES

Bell, . . . Lombard 6846, 6847, 6848
Keystone, . . . Main 0160

CONTENTS

| | PAGE |
|--|------|
| OFFICERS AND COMMITTEES, 1925 | 5 |
| PAST OFFICERS, 1824-1925 | 10 |
| PAST CHAIRMEN, COMMITTEE ON SCIENCE AND THE ARTS, 1834-1925 . . | 17 |
| THE INSTITUTE'S ACTIVITIES | 18 |
| HISTORICAL EXTRACTS | 25 |
| CENTENARY CELEBRATION PROGRAM | 41 |
| CHARTER AND BY-LAWS | 46 |
| AWARDS BY THE INSTITUTE | 56 |
| REGULATIONS OF THE COMMITTEE ON SCIENCE AND THE ARTS | 62 |
| PRESIDENT'S REPORT AND REPORTS OF THE COMMITTEES OF THE INSTITUTE AND THE COMMITTEES OF ITS BOARD OF MANAGERS | 71 |
| THE FRANKLIN INSTITUTE AWARDS, 1923-25 | 95 |
| THE FRANKLIN INSTITUTE AWARDS, 1835-1925 | 96 |
| TERMS AND PRIVILEGES OF MEMBERSHIP | 121 |
| MEMBERSHIP DIRECTORY | 123 |
| GEOGRAPHICAL DISTRIBUTION OF MEMBERS | 151 |

Transportation
Library

T

1

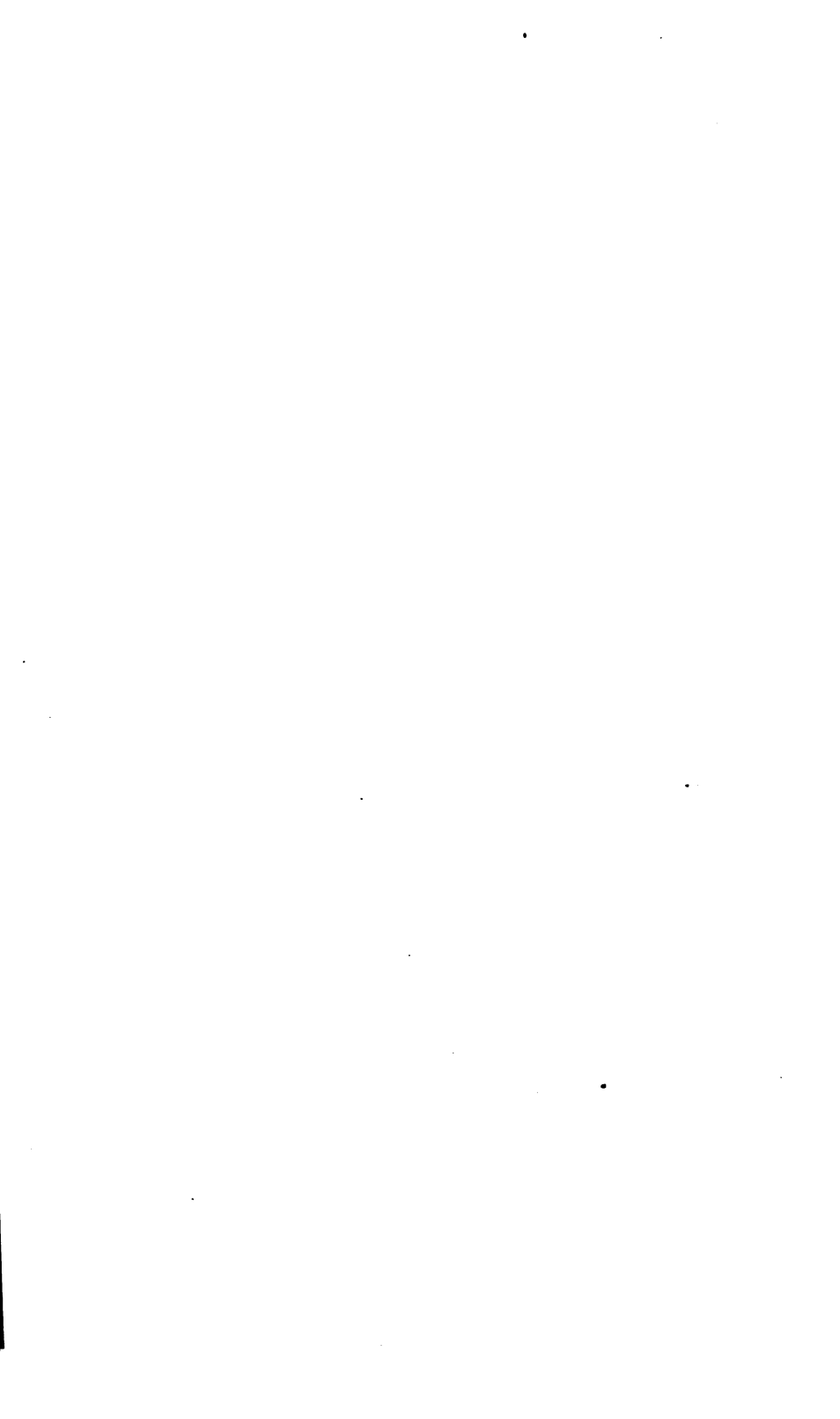
.F834 Y
1924-25

TELEPHONES

Bell, . . . Lombard 6846, 6847, 6848
Keystone, . . . Main 0160

CONTENTS

| | PAGE |
|--|------|
| OFFICERS AND COMMITTEES, 1925 | 5 |
| PAST OFFICERS, 1824-1925 | 10 |
| PAST CHAIRMEN, COMMITTEE ON SCIENCE AND THE ARTS, 1834-1925 . . | 17 |
| THE INSTITUTE'S ACTIVITIES | 18 |
| HISTORICAL EXTRACTS | 25 |
| CENTENARY CELEBRATION PROGRAM | 41 |
| CHARTER AND BY-LAWS | 46 |
| AWARDS BY THE INSTITUTE | 56 |
| REGULATIONS OF THE COMMITTEE ON SCIENCE AND THE ARTS | 62 |
| PRESIDENT'S REPORT AND REPORTS OF THE COMMITTEES OF THE INSTITUTE AND THE COMMITTEES OF ITS BOARD OF MANAGERS | 71 |
| THE FRANKLIN INSTITUTE AWARDS, 1923-25 | 95 |
| THE FRANKLIN INSTITUTE AWARDS, 1835-1925 | 96 |
| TERMS AND PRIVILEGES OF MEMBERSHIP | 121 |
| MEMBERSHIP DIRECTORY | 123 |
| GEOGRAPHICAL DISTRIBUTION OF MEMBERS | 151 |



OFFICERS AND COMMITTEES, 1925

PRESIDENT

WM. C. L. EGLIN

VICE-PRESIDENTS

HENRY HOWSON

GELLERT ALLEMAN

C. C. TUTWILER

ACTING SECRETARY

GEORGE A. HOADLEY

TREASURER

BENJAMIN FRANKLIN

BOARD OF MANAGERS*

CHARLES E. BONINE

HAROLD CALVERT

FRANCIS T. CHAMBERS

G. H. CLAMER

THEOBALD F. CLARK

WALTON CLARK

CHARLES DAY

WALTON FORSTALL

ARTHUR W. GOODSPEED

CLARENCE A. HALL

ALFRED C. HARRISON

NATHAN HAYWARD

GEORGE A. HOADLEY

ROBERT W. LESLEY

MARSHALL S. MORGAN

LAWRENCE T. PAUL

CHARLES PENROSE

JAMES S. ROGERS

GEORGE D. ROSENGARTEN

E. H. SANBORN

HASELTINE SMITH

J. T. WALLIS

WILLIAM CHATTIN WETHERILL

*The President, Vice-Presidents, Secretary, Treasurer and the Chairman of the Committee on Science and the Arts are *ex-officio* members of the Board of Managers.

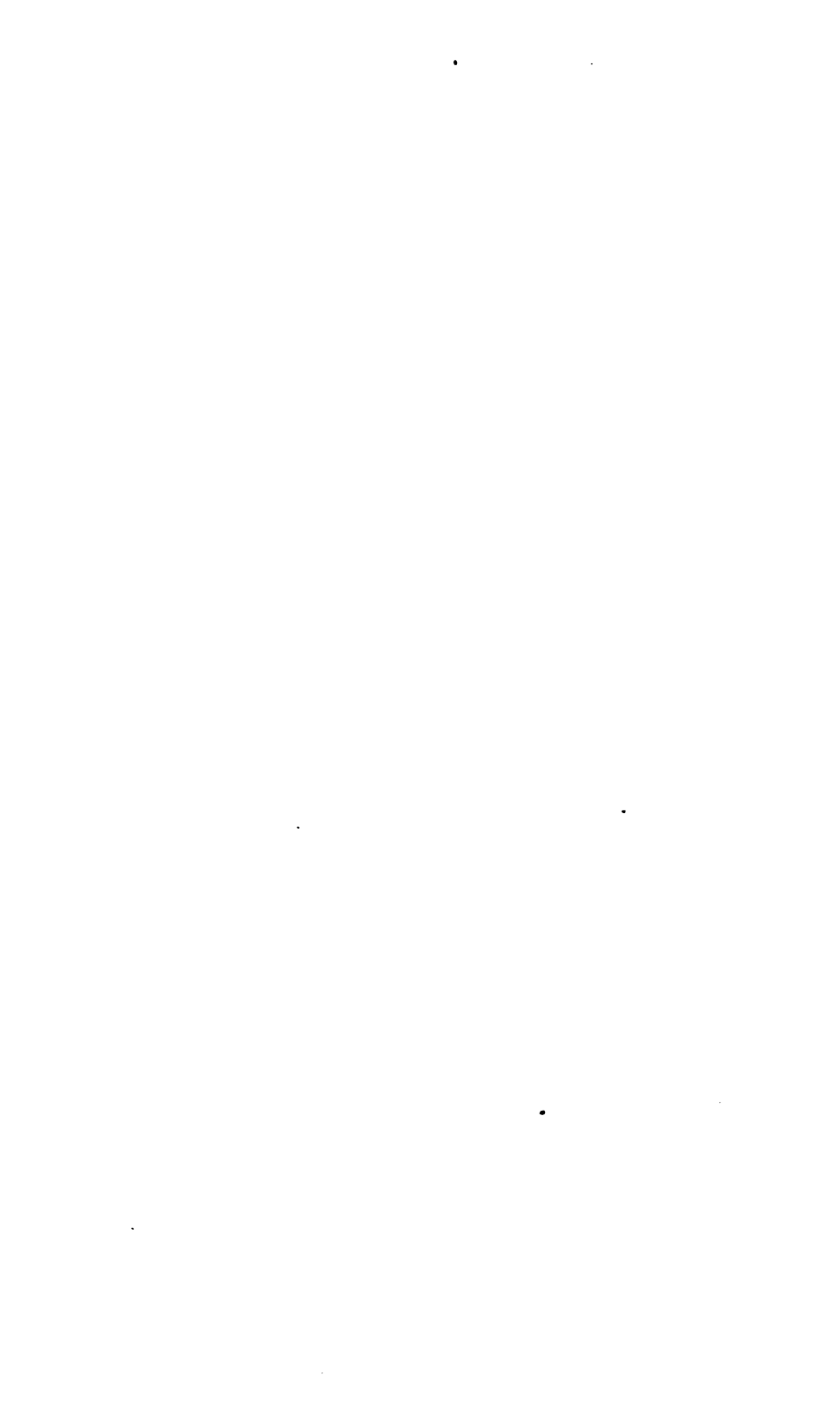
ARCHITECT

JOHN T. WINDRIM

SOLICITORS

MORGAN, LEWIS AND BOCKIUS

.



OFFICERS AND COMMITTEES, 1925

PRESIDENT

WM. C. L. EGLIN

VICE-PRESIDENTS

HENRY HOWSON

GELLERT ALLEMAN

C. C. TUTWILER

ACTING SECRETARY

GEORGE A. HOADLEY

TREASURER

BENJAMIN FRANKLIN

BOARD OF MANAGERS *

CHARLES E. BONINE

HAROLD CALVERT

FRANCIS T. CHAMBERS

G. H. CLAMER

THEOBALD F. CLARK

WALTON CLARK

CHARLES DAY

WALTON FORSTALL

ARTHUR W. GOODSPEED

CLARENCE A. HALL

ALFRED C. HARRISON

NATHAN HAYWARD

GEORGE A. HOADLEY

ROBERT W. LESLEY

MARSHALL S. MORGAN

LAWRENCE T. PAUL

CHARLES PENROSE

JAMES S. ROGERS

GEORGE D. ROSENGARTEN

E. H. SANBORN

HASELTINE SMITH

J. T. WALLIS

WILLIAM CHATTIN WETHERILL

* The President, Vice-Presidents, Secretary, Treasurer and the Chairman of the Committee on Science and the Arts are *ex-officio* members of the Board of Managers.

ARCHITECT

JOHN T. WINDRIM

SOLICITORS

MORGAN, LEWIS AND BOCKIUS

.

STAFF

GEORGE A. HOADLEY, D.Sc., Acting Secretary; Editor of the JOURNAL
OF THE FRANKLIN INSTITUTE.

ALFRED RIGLING, Assistant Secretary and Librarian; Assistant Editor,
JOURNAL OF THE FRANKLIN INSTITUTE.

WILLIAM F. JACKSON, Jr., Controller.

WALTER A. R. PERTUCH, Assistant Librarian.

MARY L. COFFIN, Secretary to Science and the Arts Assistant.

LILLIAN MORRIS, Bookkeeper, Bartol Research Foundation.

ISABELLA GRIFFITH, Bookkeeper.

CONSUELA YOUNG, Secretary to Controller.

MARGARET A. BIRKETT, Secretary to Librarian.

EMMA EWING, Cataloguer.

CLAIRE JOHNSTON, Library Assistant.

MARY B. COBLE, Telephone Operator.

HOWARD ARMSTRONG, Office Assistant.

THOMAS PLUNKETT, Library Clerk.

COMMITTEES OF THE BOARD OF MANAGERS**EXECUTIVE COMMITTEE**

| | |
|-------------------------|--------------------|
| E. H. SANBORN, Chairman | ALFRED C. HARRISON |
| CHARLES DAY | J. T. WALLIS |
| WALTON FORSTALL | |

COMMITTEE ON ENDOWMENT

| | |
|------------------------|-----------------------|
| G. H. CLAMER, Chairman | GEORGE D. ROSENGARTEN |
| BENJAMIN FRANKLIN | C. C. TUTWILER |
| ALFRED C. HARRISON | |

COMMITTEE ON FINANCE

| | |
|-----------------------------|--------------------|
| WALTON FORSTALL, Chairman | ALFRED C. HARRISON |
| HENRY HOWSON, Vice-Chairman | MARSHALL S. MORGAN |
| BENJAMIN FRANKLIN | |

COMMITTEE ON MEMBERSHIP

| | |
|----------------------------|-----------------|
| ROBERT W. LESLEY, Chairman | CHARLES PENROSE |
| CHARLES E. BONINE | HASELTINE SMITH |
| CLARENCE A. HALL | |

COMMITTEE ON PUBLICATIONS

| | |
|-------------------------|-----------------------|
| E. H. SANBORN, Chairman | GEORGE A. HOADLEY |
| GELLERT ALLEMAN | WM. CHATTIN WETHERILL |
| CHARLES E. BONINE | |

Editorial Staff of the Journal

| | |
|---------------------------|----------------------------------|
| GEORGE A. HOADLEY, Editor | ALFRED RIGLING, Assistant Editor |
|---------------------------|----------------------------------|

Associate Editors

| | |
|--------------------------|-----------------------------------|
| JOSEPH S. AMES | A. E. KENNELLY |
| WILDER D. BANCROFT | HENRY LEFFMANN |
| E. J. BERG | C. E. K. MEES |
| GEORGE K. BURGESS | RALPH MODJESKI |
| BRIG. GEN. JOHN J. CARTY | R. B. MOORE |
| E. G. COKER | MAJ. GEN. GEO. O. SQUIER |
| A. S. CUSHMAN | W. F. G. SWANN |
| ARTHUR L. DAY | CHIEF CON. D. W. TAYLOR, U. S. N. |
| A. S. EVE | A. F. ZAHM |
| PAUL D. FOOTE | JOHN ZELENY |
| W. J. HUMPHREYS | |

BARTOL RESEARCH FOUNDATION COMMITTEE

| | |
|--------------------------|--------------------|
| C. C. TUTWILER, Chairman | NATHAN HAYWARD |
| JOSEPH S. AMES | MARSHALL S. MORGAN |
| WALTON CLARK | CHARLES PENROSE |
| ARTHUR L. DAY | |

COMMITTEES OF THE INSTITUTE**COMMITTEE ON LIBRARY**

| | |
|---------------------------|---------------------|
| W. H. FULWEILER, Chairman | JOSEPH S. HEPBURN |
| JAMES BARNES | GEORGE A. HOADLEY |
| CHARLES E. BONINE | LIONEL F. LEVY |
| H. J. M. CREIGHTON | M. M. PRICE |
| CLARENCE A. HALL | GEORGE F. STRADLING |

COMMITTEE ON MEETINGS

| | |
|---------------------------|-----------------------|
| GELLERT ALLEMAN, Chairman | HERBERT E. IVES |
| JOSEPH S. AMES | A. E. KENNELLY |
| G. H. CLAMER | RALPH MODJESKI |
| ARTHUR L. DAY | GEO. D. ROSENGARTEN |
| W. H. FULWEILER | WM. CHATTIN WETHERILL |

COMMITTEE ON MUSEUM

| | |
|----------------------------------|--------------------|
| A. E. OUTERBRIDGE, Jr., Chairman | GEORGE A. HOADLEY |
| HUGO BILGRAM | JOHN J. L. HOUSTON |
| ARTHUR L. CHURCH | HENRY LEFFMANN |
| THEOBALD F. CLARK | CHARLES PENROSE |
| CHARLES DAY | H. H. QUIMBY |

FRANKLIN FUND AND BUILDING COMMITTEE

| | |
|-------------------------|--------------------|
| HENRY HOWSON, Chairman | ALFRED C. HARRISON |
| WALTON CLARK, Treasurer | |

COMMITTEE ON SCIENCE AND THE ARTS

| | |
|--------------------------|---------------------|
| HAROLD CALVERT, Chairman | H. J. M. CREIGHTON |
| HENRY B. ALLEN | GEORGE S. CULLEN |
| EUGENE E. AYRES, Jr. | SAMUEL B. ECKERT |
| JAMES BARNES | W. C. L. EGLIN |
| CLIFFORD W. BATES | WILLIAM G. ELLIS |
| GEORGE H. BENZON, Jr. | OWEN B. EVANS |
| HUGO BILGRAM | J. LOGAN FITTS |
| CHARLES E. BONINE | ISAAC H. FRANCIS |
| G. H. CLAMER | BENJAMIN FRANKLIN |
| EDWARD L. CLARK | W. H. FULWEILER |
| THEOBALD F. CLARK | CHARLES D. GALLOWAY |
| THOMAS D. COPE | CLARENCE A. HALL |
| GEORGE S. CRAMPTON | |

COMMITTEE ON SCIENCE AND THE ARTS—(Continued)

| | |
|-----------------------|------------------------|
| NATHAN HAYWARD | L. F. RONDINELLA |
| JOSEPH S. HEPBURN | J. M. RUSBY |
| GEORGE A. HOADLEY | WILLIAM OTIS SAWTELLE |
| W. N. JENNINGS | COLEMAN SELLERS, 3RD |
| WILLIAM H. KAVANAUGH | EDWARD W. SMITH |
| LIONEL F. LEVY | WILLIAM H. THORNE |
| K. G. MACKENZIE | JOHN C. TRAUTWINE, 3RD |
| J. Y. McCONNELL | C. C. TUTWILER |
| CHAS. H. MASLAND, 2ND | JAMES G. VAIL |
| STEPHEN H. NOYES | JOHN A. VOGLESON |
| FREDERIC PALMER, JR. | FRANCIS R. WADLEIGH |
| CHARLES PENROSE | JOHN M. WEISS |
| M. M. PRICE | HOWARD W. WELLES |
| H. H. QUIMBY | WM. CHATTIN WETHERILL |
| FRANK H. ROGERS | ROBERT L. WOOD |
| JAMES S. ROGERS | WINTHROP R. WRIGHT |

Standing Sub-Committees
The Franklin Medal

| | |
|------------------------|--------------------|
| JAMES BARNES, Chairman | H. J. M. CREIGHTON |
| CHARLES E. BONINE | BENJAMIN FRANKLIN |
| G. H. CLAMER | |

Literature

| | |
|------------------------------|----------------|
| H. J. M. CREIGHTON, Chairman | LIONEL F. LEVY |
| CHARLES E. BONINE | J. M. RUSBY |
| BENJAMIN FRANKLIN | |

New Subjects and Preliminary Examination

| | |
|------------------------------|-----------------|
| H. J. M. CREIGHTON, Chairman | NATHAN HAYWARD |
| JAMES BARNES | LIONEL F. LEVY |
| CHARLES E. BONINE | CHARLES PENROSE |
| GEORGE S. CRAMPTON | M. M. PRICE |
| BENJAMIN FRANKLIN | JAMES S. ROGERS |
| CLARENCE A. HALL | JOHN M. RUSBY |

PAST OFFICERS

1824-1925

PRESIDENTS

| | |
|--------------------------------|-------------------------------|
| BANES, CHARLES H., 1886 | ROGERS, ROBERT E., 1875-1878 |
| BIRKINBINE, JOHN, 1897-1906 | RONALDSON, JAMES, 1824-1841 |
| CLARK, WALTON, 1907-1923 | SELLERS, COLEMAN, 1870-1874 |
| CRESSON, JOHN C., 1855-1863 | SELLERS, WILLIAM, 1864-1866 |
| EGLIN, WM. C. L., 1924- | TATHAM, WILLIAM P., 1879-1885 |
| MERRICK, J. VAUGHAN, 1867-1869 | WILSON, JOSEPH M., 1887-1896 |
| MERRICK, SAMUEL V., 1842-1854 | |

VICE-PRESIDENTS

| | |
|--|--------------------------------------|
| AGNEW, JOHN, 1851, 1855-1863 | HOWSON, HENRY, 1904- |
| ALLEMAN, GELLERT, 1924- | JONES, WASHINGTON, 1900-1910 |
| BALDWIN, MATTHIAS W., 1855-1863 | LEVY, LOUIS E., 1916-1919 |
| BECK, PAUL, JR., 1826-1827 | LONGSTRETH, EDWARD, 1890-1894 |
| BULLOCK, CHARLES, 1879-1900 | LUKENS, ISAIAH, 1824-1825, 1829-1846 |
| CAREY, MATTHEW, 1824-1828 | MILLER, ABRAHAM, 1847-1854 |
| CARTWRIGHT, HENRY, 1880-1881 | MITCHELL, J. E., 1876-1887 |
| CHRISTIE, JAMES, 1911 | MOORE, BLOOMFIELD H., 1869-1876 |
| CLOSE, CHARLES S., 1875-1879 | MORRIS, HENRY G., 1870-1879 |
| CRESSON, GEORGE V., 1898-1903 | RAND, THEODORE D., 1897-1903 |
| DAY, CHARLES, 1920-1923 | ROGERS, FAIRMAN, 1864-1866 |
| DODGE, JAMES M., 1903-1915 | ROGERS, ROBERT E., 1868-1874 |
| EGLIN, W. C. L., 1922-1923 | SELLERS, COLEMAN, 1867-1869 |
| EREBY, GEORGE, 1867 | SELLERS, COLEMAN, JR., 1912-1922 |
| FLETCHER, THOMAS, 1828-1850, 1852-1854 | TATHAM, WILLIAM P., 1888-1897 |
| FRAZER, JOHN F., 1865-1866 | TOWNE, JOHN H., 1864-1868 |
| GRAFF, FREDERICK, 1882-1890 | TUTWILER, C. C., 1924- |
| HEYL, HENRY R., 1895-1897 | |

RECORDING SECRETARIES

| | |
|--------------------------------------|--------------------------------|
| BULKLEY, JAMES H., 1831-1832 | PEROT, WILLIAM S., 1833-1834 |
| GARRIGUES, ISAAC B., 1830, 1837-1863 | ROBERTS, ALGERNON S., 1829 |
| JONES, THOMAS P., 1827-1828 | STRICKLAND, WILLIAM, 1824-1826 |
| JONES, WASHINGTON, 1864 | TRAUTWINE, JOHN C., 1835-1836 |

CORRESPONDING SECRETARIES

| | |
|--------------------------------|--------------------------------|
| BACHE, ALEX. DALLAS, 1840-1844 | FRALEY, FREDERICK, 1855-1863 |
| BRIGGS, ROBERT, 1864 | FRAZER, JOHN F., 1845-1847 |
| BROWNE, PETER A., 1824-1827 | HAYS, ISAAC, 1828-1839 |
| CRESSON, JOHN C., 1854 | ROBERTS, SOLOMON W., 1848-1853 |

SECRETARIES

| | |
|------------------------------------|--|
| CHRISTIE, JAMES, 1909 | NORRIS, ISAAC, 1879-1881 |
| HOADLEY, GEORGE A. (Acting), 1924- | OWENS, ROBERT B., 1910-1924 |
| KNIGHT, J. B., 1875-1879 | WAHL, WILLIAM H., 1871-1874, 1882-1908 |
| MORTON, HENRY, 1865-1870 | |

TREASURERS

| | |
|---|-------------------------------|
| BORGNER, CYRUS, 1908-1920 | MERRICK, SAMUEL V., 1828-1829 |
| FLETCHER, THOMAS, 1824-1825 | RICHARDSON, JOHN, 1826-1827 |
| FRALEY, FREDERICK, 1830-1847, 1865-1882 | SARTAIN, SAMUEL, 1883-1906 |
| FRANKLIN, BENJAMIN, 1920- | TREGO, CHARLES B., 1847 |
| FRAZER, JOHN F., 1848-1864 | WAHL, WILLIAM H., 1907 |

ACTUARIES

| | |
|--|----------------------------------|
| CHRISTIE, JAMES, Feb. 21-June 11, 1908 | JESTER, SIMEON VAN T., 1916-1918 |
| HAMILTON, WILLIAM, 1828-1871 | LARZELERE, JAMES S., 1908-1916 |
| HEYL, HERBERT L., 1885-1908 | PARRISH, T. R., 1922-1924 |
| HOLMAN, DAVID S., 1872-1885 | ROBINSON, LOUIS C., 1918-1922 |
| JACKSON, WILLIAM F., JR., 1924- | WAHL, WILLIAM H., 1872 |

LIBRARIANS

| | |
|--------------------------------|------------------------|
| HILTEBRAND, EMANUAL, 1874-1887 | RIGLING, ALFRED, 1887- |
|--------------------------------|------------------------|

CONTROLLERS

| |
|---------------------------------|
| JACKSON, WILLIAM F., JR., 1925- |
|---------------------------------|

MANAGERS

| | |
|-----------------------------------|---|
| ABBOT, WILLIAM, 1824-1826 | ARCHER, ELLIS S., 1858-1859 |
| ADAMSON, WILLIAM, 1864 | BACHE, ALEX. DALLAS, 1830-1839 |
| ADDICKS, JOHN E., 1845-1850 | BALCH, EDWIN S., 1902-1912 |
| AGNEW, JOHN, 1831-1850, 1852-1854 | BALDWIN, MATTHIAS W., 1827-1854 |
| ALLEMAN, GELLERT, 1918-1923 | BANES, CHARLES H., 1877-1885, 1887-1895 |
| ALLEN, JAMES, 1845 | |
| ALLISON, WILLIAM C., 1863 | BARKER, GEORGE F., 1874-1875 |

MANAGERS—(Continued)

- BARRAS, JOSEPH J., 1851-1860
 BARTOL, BARNABAS H., 1863-1865
 BARTOL, HENRY W., 1870-1878
 BAUGH, DANIEL, 1900-1902
 BAUGH, HARMAN, 1855
 BEALE, JOSEPH, 1827
 BEARDSLEY, ARTHUR, 1894-1902
 BECK, PAUL, JR., 1824-1825
 BEMENT, CLARENCE S., 1871
 BEMENT, WILLIAM B., 1866-1870
 BERGNER, THEODORE, 1870-1875
 BETTS, WILLIAM C., 1844
 BIDDLE, CLEMENT C., 1824
 BILGRAM, HUGO, 1885-1890
 BIRKBECK, JOHN, 1869-1871
 BIRKINBINE, HENRY P. M., 1851-1856
 BIRKINBINE, JOHN, 1907-1915
 BOLTON, JAMES M., 1830
 BONINE, CHARLES E., 1921-
 BORGNER, CYRUS, 1903-1907
 BOSWELL, WILLIAM L., 1896-1898
 BOWER, HENRY, 1891-1896
 BRIGGS, ROBERT, 1867-1873
 BROCK, ROBERT C. H., 1901-1906
 BROLASKY, HENRY C., 1897-1902
 BRYSON, JAMES H., 1857-1863
 BULKLEY, JAMES H., 1830, 1833-1841
 BULLOCK, CHARLES, 1868-1878
 BURNHAM, GEORGE, 1878
 BURTIS, AARON H., 1845
 CARR, WILLIAM H., 1837-1845
 CARTWRIGHT, HENRY, 1865-1879
 CHABOT, CYPRIEN, 1877-1889
 CHAMBERS, CYRUS, JR., 1876-1890
 CHRISTIE, JAMES, 1897-1908
 CHASE, PLINY E., 1864-1886
 CHRISTIE, JAMES, 1897-1908
 CLAMER, G. H., 1917-
 CLARK, THEOBALD F., 1917-
 CLARK, WALTON, 1903-1906
 CLARKE, JAMES, 1824-1826
 CLOSE, CHARLES S., 1865-1874
 CLOUD, JOSEPH, 1824
 CODMAN, JOHN E., 1892-1894
 COLLINS, ISAAC, 1828
 CONARD, THOMAS P., 1894-1908
 CONARROE, GEORGE W., 1851-1863
 COOPER, JOHN H., 1870-1873
 COPPER, JOHN C., 1851
 CORNELIUS, ROBERT, 1855-1863
 CORNELIUS, ROBERT C., 1866-1868
 CRAMP, CHARLES H., 1864-1867, 1875,
 1895-1897
 CRESSON, GEORGE V., 1886-1897
 CRESSON, JOHN C., 1835-1853
 CRESSON, WILLIAM P., 1848-1849
 DARRACH, CHARLES G., 1894-1896
 DAY, CHARLES, 1908-1919, 1924-
 DIVINE, WILLIAM, 1864
 DODGE, KERN, 1916-1920
 DODGE, JAMES M., 1896-1903
 DONALDSON, JOSEPH, 1825
 DOUGHERTY, JAMES, 1858-1861
 DRAPER, EDMUND, 1847-1850
 DREER, FERDINAND J., 1862
 DROWN, WILLIAM A., 1861-1863
 DU BOIS, WILLIAM L., 1880-1882
 DUFFEE, WILLIAM F., 1872-1873
 EASTWICK, ANDREW M., 1836-1844
 EASTWICK, EDWARD P., 1859-1860
 EBERT, MORRIS, 1908-1911
 ECKERT, GEORGE M., 1852-1854
 EGLIN, W. C. L., 1908-1922
 EISENHUT, JOHN D., 1824-1825
 ELDRIDGE, G. MORGAN, 1885-1890
 ELLIS, JAMES P., 1848-1851
 EMERSON, G., 1828
 EREBY, GEORGE, 1854-1866

MANAGERS—(Continued)

- EVANS, OWEN, 1844-1857
 EVANS, OWEN, 1844-1857
 FERGUSON, ALEXANDER, 1831-1841
 FLETCHER, THOMAS, 1826-1827
 FLING, WILLIAM B., 1842
 FORSTALL, WALTON, 1908-
 FOX, GEORGE, 1828-1830
 FRALEY, FREDERICK, 1829, 1848-1854
 FRANKLIN, BENJAMIN, 1917-
 FRAZER, JOHN F., 1844, 1865-1866
 FRAZER, PERSIFOR, 1880-1891, 1903-1909
 FRAZIER, GEORGE H., 1898
 FRENCH, HOWARD B., 1900
 FRY, WILLIAM, 1825
 GARDINER, JOHN, JR., 1864
 GARRIGUES, ISAAC B., 1825-1829, 1831-1836
 GARRISON, F. LYNWOOD, 1890-1895, 1897-1903
 GAWTHROP, HENRY, 1896-1898
 GIBBS, ALFRED W., 1915-1922
 GIBSON, J. HOWARD, 1893-1894
 GIBSON, JOHN J., 1912-1915
 GILDER, JOHN, 1838-1841
 GILPIN, THOMAS, 1824
 GOBRECHT, CHRISTIAN, 1828-1830
 GOLDSMITH, E., 1908-1916
 GOODSPEED, ARTHUR W., 1925-
 GRAHAM, HOWARD S., 1920-1921
 GRAFF, FREDERICK, 1852-1854, 1858-1865, 1880-1881
 GREBLE, EDWIN, 1841-1863
 GREENE, STEPHEN, 1898-1908
 GRIES, JOHN M., 1858-1862
 GRIFFITH, R. EGGLEFIELD, 1870-1871
 GRIFFITH, ROBERT E., 1827
 GROVES, DANIEL, 1824-1827
 HALL, CLARENCE A., 1922-
 HAND, JAMES C., 1845-1846
 HANSELL, WILLIAM S., 1827
 HARDING, GEORGE, 1864-1865
 HARKER, JOSHUA G., 1831-1836
 HARPER, JAMES, 1824-1826
 HARRIS, WILLIAM, 1860-1863
 HARRIS, WILLIAM, 1860-1863
 HARRISON, ALFRED C., 1895-
 HARRISON, C. LELAND, 1899-1902
 HARRISON, JOHN, 1824-1829
 HARRISON, JOSEPH, JR., 1854, 1856-1859
 HART, SAMUEL, 1865-1870
 HAVILAND, JOHN, 1824-1826
 HAYS, ISAAC, 1840-1841
 HAYWARD, NATHAN, 1917-
 HELLER, CHARLES S., 1879-1880
 HELME, WILLIAM, 1859-1888
 HENDERSON, GEORGE R., 1915-1921
 HERSE, GEORGE P., 1851
 HEXAMER, CHARLES A., 1904-1925
 HEYL, HENRY R., 1879-1895, 1898-1909
 HOADLEY, GEORGE A., 1911-
 HORN, HENRY, 1824
 HORSTMANN, WILLIAM J., 1865-1868
 HOUSTON, EDWIN J., 1874-1897
 HOWARD, GEORGE C., 1855-1858
 HOWE, HERBERT M., 1898-1900
 HOWSON, CHARLES HENRY, 1903-1907
 HOWSON, HENRY, 1898-1903
 HUFTY, SAMUEL, 1834-1850
 HUMPHREYS, SAMUEL, 1826
 HUNTER, JAMES, 1864
 HUTCHINSON, CHARLES H., 1888-1890
 HUTCHINSON, JAMES, 1841-1842
 HUTCHINSON, JOSEPH, 1860-1863
 JAYNE, HARRY W., 1891-1910
 JENNINGS, W. N., 1896
 JOHNSON, LAWRENCE, 1855-1859

MANAGERS—(Continued)

- JONES, THOMAS P., 1826
 JONES, WASHINGTON, 1859-1895, 1897-1900
 KATEZ, I., 1824
 KEATING, WILLIAM H., 1824-1826, 1830-1840
 KELLER, HARRY F., 1914-1924
 KELLY, HENRY H., 1851
 KING, ROBERT P., 1851
 KIRK, CHARLES H., 1830
 KIRKPATRICK, GEORGE E., 1911-1914
 KLUMPP, JOHN BARTLEMAN, 1923
 KNEASS, WILLIAM, 1825
 KNIGHT, DANIEL R., 1845
 KRUMBHAAR, ALEXANDER, 1898-1911
 KUHN, C. HARTMAN, 1896-1905
 LAMBERT, WM. H., 1906
 LESLEY, ROBERT W., 1913-
 LE VAN, W. BARNET, 1864-1876
 LEVY, LOUIS E., 1903-1915
 LEWIS, ENOCH, 1868-1894
 LEWIS, HARVEY, 1824-1827
 LEWIS, MORDECAI D., 1828-1836
 LINDSAY, JOHN, 1843
 LINDSAY, ROBERT, 1834-1836
 LINNARD, JAMES M., 1836-1838
 LINVILLE, J. HAYES, 1868
 LONGSTRETH, CHARLES, 1903-1907
 LONGSTRETH, EDWARD, 1868-1870, 1895-1897
 LOUD, THOMAS, 1829-1831
 LOVE, WILLIAM H., 1859
 LUCAS, JOHN, 1888-1894
 LUKENS, ISAIAH, 1828
 LUKENS, JAWOOD, 1902-1908
 LYMAN, BENJAMIN S., 1901-1902
 McALPINE, JAMES, 1825-1828
 McCaffrey, E. V., 1910-1924
 McCAMBRIDGE, RICHARD, 1876
 McCLURE, JOHN, 1853-1856
 McCLURG, ALEXANDER, 1833-1839
 McEuen, THOMAS, 1829
 McKean, WILLIAM V., 1879-1883
 MARKS, WILLIAM D., 1881-1884
 MARSHALL, SAMUEL R., 1887-1893
 MASON, DAVID H., 1824
 MASON, JAMES S., 1861
 MEGARGE, CHARLES, 1858
 MEIRS, RICHARD WALN, 1908-1917
 MERRICK, J. VAUGHAN, 1864-1866, 1870-1884
 MERRICK, SAMUEL V., 1824-1827, 1830-1841, 1855-1863
 MIFFLIN, LLOYD, 1825-1826
 MILES, FREDERICK B., 1874
 MILLER, ABRAHAM, 1824-1846, 1855-1858
 MITCHELL, J. E., 1874
 MITCHELL, WILLIAM A., 1864-1865
 MOORE, BLOOMFIELD H., 1864-1868
 MOORE, JOSEPH W., 1860-1861
 MORGAN, MARSHALL S., 1914-
 MORRIS, ELWOOD, 1844-1847
 MORRIS, HENRY G., 1864-1869
 MORRIS, ISAAC P., 1836-1843
 MORRIS, WILLIAM E., 1847-1851
 MUCKLE, M. RICHARDS, JR., 1894-1896
 NAYLOR, JACOB, 1863, 1865-1872
 NEAFIE, JACOB G., 1868
 NEWHALL, PAUL W., 1843-1844
 NORRIS, ISAAC, 1870-1878, 1883-1918
 NYSTROM, JOHN W., 1873-1875
 OGDEN, JOHN M., 1833
 OGLE, WILLIAMS, 1845-1850
 O'NEILL, JOHN, 1827-1832
 ORR, HECTOR, 1871-1887
 OUTERBRIDGE, ALEX. E., JR., 1881-1886
 PALMER, B. FRANKLIN, 1862

MANAGERS—(Continued)

- PARRISH, WILLIAM D., 1838, 1852-1854
 PARRY, CHARLES T., 1864
 PATTERSON, ROBERT, 1824
 PATTERSON, ROBERT M., 1825-1827
 PAUL, LAWRENCE T., 1895-
 PEMBERTON, HENRY, JR., 1891-1896
 PENROSE, CHARLES, 1925-
 PERRY, ROBERT S., 1912-1916
 PETTIT, HORACE, 1894-1910
 PURVES, ALEXANDER, 1875-1876
 RALSTON, ASHBEL G., 1825-1830
 RAMAGE, ADAM, 1824-1832
 RAND, THEODORE D., 1874-1897
 REED, WILLIAM B., 1832-1836
 REEVES, BENJAMIN, 1829-1837
 REEVES, SAMUEL J., 1864
 REEVES, STACY, 1889-1902
 RICE, JOHN, 1866-1867
 RICHARDS, MARK, 1831
 RICHARDSON, JOHN, 1825
 RIEHLE, HENRY J., 1826-1827
 ROBBINS, SAMUEL J., 1827-1833
 ROBERTS, ALGERNON S., 1828
 ROBERTS, PERCIVAL, 1864-1868
 ROBERTS, SOLOMON W., 1842-1847
 ROBINSON, ALEXANDER P., 1911-1916
 ROGERS, EVANS, 1854-1863
 ROGERS, HENRY D., 1838-1843
 ROGERS, JAMES S., 1909-
 ROGERS, ROBERT E., 1867
 RONALDSON, CHARLES E., 1885-1893, 1908-1912
 ROSENGARTEN, GEORGE D., 1912-
 ROWLAND, JAMES, JR., 1829-1830
 ROWLAND, WILLIAM, 1828
 RUSH, WILLIAM, 1825
 RUST, JAMES I., 1824
 SADTLER, SAMUEL P., 1888-1897
 SANBORN, E. H., 1907-
 SARTAIN, JOHN, 1877-1879
 SARTAIN, SAMUEL, 1865-1882
 SAVERY, PELEG B., 1851-1852
 SAXTON, JOSEPH, 1842-1844
 SAY, BENJAMIN, 1832-1833
 SCATTERGOOD, THOMAS, 1829-1834
 SCHAUM, OTTO W., 1907
 SCHREINER, JOSEPH H., 1827-1832
 SCHUMANN, FRANCIS, 1899-1902
 SEIPER, THOMAS, 1824
 SELLERS, COLEMAN, 1862-1866, 1875-1905
 SELLERS, COLEMAN, JR., 1906-1911
 SELLERS, WILLIAM, 1857-1861, 1867-1892
 SHAIN, CHARLES J., 1884-1887
 SHINN, EARLE, 1836-1837
 SLOAN, SAMUEL, 1864
 SMITH, CHARLES E., 1852-1855
 SMITH, HASELTINE, 1922-
 SOUDER, JACOB, 1828
 SPANGLER, HENRY W., 1891-1893
 STEVENSON, WILLIAM, JR., 1828
 STEWART, THOMAS S., 1842-1850, 1852-1863
 STRICKLAND, WILLIAM, 1828
 STRUTHERS, JOHN, 1827-1849
 TABER, GEORGE, 1839-1842
 TATHAM, WILLIAM P., 1870-1878, 1886-1887
 THOMPSON, AMBROSE W., 1839-1843
 THOMSON, ELIHU, 1878-1881
 THORNE, WILLIAM H., 1881-1897
 THORNLEY, JOHN, 1851
 TILGHMAN, BENJ. C., 1871-1875
 TOPPAN, CHARLES, 1831-1832
 TOWNE, JOHN H., 1840-1857, 1869
 TOWNSEND, EDWARD Y., 1866-1867

MANAGERS—(Continued)

- TRACY, ELIASHIB, 1851
 TRAUTWINE, JOHN C., 1834, 1844, 1852-1857
 TRAUTWINE, JOHN C., JR., 1891-1895
 TREGG, CHARLES B., 1837-1846
 TREVOR, JOHN B., 1832
 TKOTH, HENRY, 1837-1841
 TRYSON, GEORGE W., 1831-1833
 TUTWILER, C. C., 1920-1923
 TYLER, RUFUS, 1826-1837
 VAUCLAIN, SAMUEL M., 1898, 1906
 VAUX, GEORGE, JR., 1898-1899
 WALLIS, J. T., 1923-
 WALTER, JOSEPH S., JR., 1834-1837
 WALTER, THOMAS U., 1829-1831, 1840-1851
 WARDER, WILLIAM S., 1825-1827
 WARNER, JOHN S., 1837-1843
 WEAVER, JACOB, 1856-1857
 WEAVER, JOHN J., 1880-1891
 WEIGHTMAN, WILLIAM, 1862-1863
 WETHERILL, CHARLES, 1835
 WETHERILL, J. P., 1902
 WETHERILL, JOHN P., 1824-1825
 WETHERILL, WILLIAM, 1832
 WETHERILL, WILLIAM C., 1916-
 WEYGANDT, THOMAS J., 1851-1863
 WHARTON, WILLIAM, JR., 1871
 WHITAKER, GEORGE P., 1851-1852
 WHITE, CHARLES H., 1828-1835
 WHITE, SAMUEL S., 1864-1867
 WHITNEY, ASA, 1846-1850
 WHITNEY, GEORGE, 1858-1860
 WHITNEY, JAMES S., 1862-1863, 1865-1869
 WHITNEY, JOHN R., 1861
 WICKHAM, M. T., 1824
 WIEGAND, JOHN, 1831-1853
 WIEGAND, S. LLOYD, 1864, 1890-1893
 WILLIAMS, EDWARD H., 1871-1872
 WILLIAMS, ISAAC S., 1846-1850, 1852-1863
 WILSON, JOSEPH M., 1869-1886
 WILSON, O. HOWARD, 1864-1869
 WOLBORN, CORNELIUS A., 1844-1850
 WOLF, OTTO C., 1897-1913
 WOOD, ALAN, 1845-1863
 WOOD, SAMUEL R., 1824-1825
 WOOD, WALTER, 1903-1912
 WOOTEN, JOHN E., 1860-1862
 YARDLEY, WILLIAM, JR., 1829
 YEAGER, JOSEPH, 1832
 YOUNG, ANDREW, 1828-1830

PAST CHAIRMEN OF THE COMMITTEE ON SCIENCE AND THE ARTS, 1834-1925

| | |
|---|---|
| BACHE, ALEXANDER D., 1834-1836, 1839-1844 | HOADLEY, GEORGE A., 1911-1912 |
| BARNES, JAMES, 1922-1923 | KOENIG, G. A., 1888-1889 |
| BEARDSLEY, ARTHUR, 1892-1895 | LEVY, LOUIS E., 1901-1902 |
| BENZON, GEORGE H., JR., 1924-1925 | LEWIS, WILFRED, 1912-1913 |
| BILGRAM, HUGO, 1906-1907 | MARBURG, EDGAR, 1899-1900 |
| BONINE, CHARLES E., 1916-1917 | MARKS, W. D., 1881-1882, 1887-1888 |
| CALVERT, HAROLD, 1925- | MASLAND, CHARLES W., 1921-1922 |
| CHRISTIE, JAMES, 1897-1898 | McCONNELL, JACOB Y., 1909-1910 |
| CLAMER, G. H., 1915-1916 | ORR, HECTOR, 1880-1881 |
| CONARD, THOMAS P., 1902-1903 | PATTERSON, R. M., 1836-1839 |
| CREIGHTON, H. JERMAIN, 1918-1919 | PENROSE, CHARLES, 1920-1921 |
| CRESSON, J. C., 1844-1874 | ROGERS, JAMES S., 1908-1909 |
| CRISFIELD, J. A. P., 1913-1914 | RONALDSON, CHARLES E., 1903-1904 |
| ELDRIDGE, G. MORGAN, 1896-1897 | RONDINELLA, L. F., 1898-1899 |
| FRANKLIN, BENJAMIN, 1919-1920 | SARTAIN, SAMUEL, 1895-1896 |
| FULWEILER, W. H., 1923-1924 | SELLERS, COLEMAN, 1875-1880 |
| GOLDSMITH, EDWARD, 1905-1906 | SPANGLER, H. W., 1890-1891 |
| GRIGGS, WILLIAM O., 1907-1908 | SPENCER, THOMAS, 1910-1911 |
| HAUPT, LEWIS M., 1904-1905 | WETHERILL, WM. CHATTIN, 1917-1918 |
| HENDERSON, GEORGE R., 1914-1915 | WIEGAND, S. LLOYD, 1889-1890, 1891- 1892 |
| HEYL, HENRY R., 1882-1887, 1893- 1894, 1900-1901 | |

THE INSTITUTE'S ACTIVITIES

THE FRANKLIN INSTITUTE was organized in the year 1824 to meet a demand in America for an Institution similar to that founded by Count Rumford in London in 1799. The founders intended it not only as an appropriate memorial to the name of Franklin, but as a means of continuing for all time a work which throughout his long life he perhaps regarded as his best, namely, the discovery of physical and natural laws and their application to increase the well-being and comfort of mankind.

The Hall of the Institute is located on the east side of Seventh Street, between Market and Chestnut Streets, and was built from plans furnished by John Haviland, architect. The corner-stone was laid with appropriate Masonic and other ceremonies, on the eighth day of June, 1825, at noon. The funds for the purchase of the lot and the erection of the building were provided by the issue of a building loan, which was freely taken by members and friends of the enterprise, and has long since been repaid. The building was completed, and the Institute took possession of all except the second floor (which was occupied by the United States Courts until 1830) in 1826. Upon the first floor are located the lecture-room (capable of accommodating about 300), and laboratories and offices. The second floor is occupied by the library, to which special attention is paid elsewhere. The third floor is given up entirely to the Museum of Models and Historical Apparatus.

THE LIBRARY

The plan of the founders contemplated "the formation of a library of books relating to science and the useful arts, and the opening of a reading-room"; and, accordingly, in 1827, the first Committee on Library was appointed.

The books forming the nucleus of the library were stored in the residence of a member of the committee until early in the year 1829, when the first reading room was opened. During the next year a special committee of twenty issued an appeal for books and contributions of money in aid of the library.

The founding of the JOURNAL, in 1826, by opening the way to the establishment of exchange relations with other societies and with the leading magazines and periodicals devoted to science and the useful arts, proved an invaluable help in promoting its growth, and thus, early, gave to the library the distinctive character which it has since maintained. From the nucleus formed by this useful agency has grown a reference library of scientific literature, in some branches unique, and, in extent and completeness, second to none in the United States, embracing the publications of the principal scientific and technical societies of the world, and the leading periodicals devoted to science and the arts.

Several of the foreign governments have deposited with the library complete sets of their patent office publications. There are on the shelves for reference files of the specifications of the patent office of Great Britain since the year 1617, of Switzerland since 1888, of the United States since 1790. The specifications of French patents 1791 to 1900 and abstracts of the patents

granted by Germany, Russia, Canada, Australia, Hungary and Austria can also be consulted.

The library is annually enriched, also, by the gift of numerous technical publications of a miscellaneous character from foreign governments, and from States and municipal authorities and corporations. These embrace publications relating to public works; official reports relating to geology, the mining and metallurgical industries, agriculture, public health, municipal engineering; reports of railway and other transportation companies, manufacturing corporations, etc.

For many years it has been the policy of this committee to increase the value of the collection as a library of reference, and to this end it has devoted systematic efforts to the task of completing the files of its important serial publications. In this work, the committee, with the substantial assistance of several liberal contributions of money from generous friends of the Institute, has been notably successful.

At the present time the collection consists of 82,941 volumes and 20,655 pamphlets.

To inventors and manufacturers seeking for information respecting the state of the arts and manufactures, the extensive collection of patent literature which the library places at their disposal is indispensable, and the library is constantly resorted to by attorneys and their clients for the purpose of consulting these volumes; while, to the professional man and the student, the scientific and technical serials in which the library is so rich are no less indispensable as an aid in pursuing the investigations.

The library is open daily from 9 o'clock A.M., until 5 o'clock P.M., Saturdays twelve o'clock noon. The Institute is closed on all state and national holidays.

THE COMMITTEE ON SCIENCE AND THE ARTS

A branch of the Institute's work, which, perhaps, more obviously than any other, illustrates the spirit which animated the founders, and which their successors have worthily perpetuated and striven to improve and extend, is that which is now conducted by the Committee on Science and the Arts.

One of the things that was, apparently, uppermost in the thoughts of the founders, was the need—as urgent then as to-day—felt by inventors and discoverers, of some competent, trustworthy and impartial body, to whom they could safely appeal for advice, and on whose judgment they could confidently rely for an opinion, as to the usefulness of their inventions and discoveries.

One of the first acts of the Board of Managers was to appoint a Board of Examiners, whose duty it was to examine and make report upon all new and useful machines, inventions and discoveries submitted to them. Subsequently the name of the Board of Examiners was changed to the "Committee on Inventions."

This organization continued in existence until the year 1834, when, by act of the Institute, it was abolished, and in its place there was established the "Committee on Science and the Arts," with enlarged powers and a wider field of labor. As originally constituted, membership in this committee was open to all members of the Institute in good standing who chose to enroll their names, and who by thus voluntarily associating themselves with the committee, pledged themselves to perform the duties assigned to them.

Under this form of organization the committee continued for more than fifty years, and its usefulness during this long period is attested by its records, containing the results of the examination of a great number of inventions, and of its investigations of many subjects of importance entrusted to it by the Institute.

In the year 1886, the Institute adopted an amendment to its by-laws, by which this committee was reorganized on an elective basis, thus abolishing the plan of voluntary association which had heretofore been a distinguishing feature. By this amendment the Institute established a Committee on Science and the Arts, to be composed of forty-five members of the Institute, to be chosen at the annual election (fifteen each year), and "who shall pledge themselves by their acceptance of membership to perform such duties as may devolve upon them, and to sustain by their labors the scientific character of the Institute."

Some years later the membership of the committee was increased from forty-five to sixty and by a provision recently adopted the members are elected by the Board of Managers, twenty each year.

During the past twenty-five years the committee has investigated nearly 1000 discoveries, processes, and inventions.

THE JOURNAL

The publication of a journal for the diffusion of knowledge on all subjects connected with science and the useful arts, was embraced in the plan of the founders, and was undertaken shortly after the organization had been effected. This publication has been continued without interruption to the present time, and has proved most useful, not only in directly promoting the aims and objects of the Institute, but also in extending the sphere of its influence beyond the limits of its local habitation.

The first step to secure a publication was taken by the Institute as early as 1825, when, by arrangement with C. S. Williams, publisher, a magazine bearing the title *The American Mechanics' Magazine*, and which had been founded by him in New York at the beginning of that year, was acquired by Dr. Thomas P. Jones, who had recently been elected professor of mechanics in The Franklin Institute. At the outset the responsibility of this venture appears to have been assumed by Dr. Jones, after he had received assurances of active coöperation and support from the members of the Institute, who were warmly interested in its success.

The prospectus of the new publication, which was issued August 1, 1825, announced the fact that "shortly will be published

THE FRANKLIN JOURNAL AND MECHANICS' MAGAZINE,

UNDER THE PATRONAGE OF

THE FRANKLIN INSTITUTE, OF THE STATE OF PENNSYLVANIA, FOR THE PROMOTION OF THE
MECHANIC ARTS, EDITED BY DR. THOMAS P. JONES, PROFESSOR OF
MECHANICS IN THE INSTITUTE."

The object of *The Franklin Journal*, as defined in the prospectus, was, "to diffuse information on every subject connected with useful arts."

In the prospectus of *The Franklin Institute* attention is called to the fact that it was intended to give a list of patented inventions, with remarks upon their utility and originality. This proposition was literally maintained and continued as a prominent feature of the JOURNAL to the close of 1859, save that the "Remarks," which were in many cases of the greatest value to those interested in the progress of the arts and manufactures, were discontinued on the death of Dr. Jones. His accession to the position of Superintendent of the Patent Office naturally caused him to devote special attention to the preservation of the record of patents in the pages of the JOURNAL. This circumstance has since proved of considerable value to all who have need to refer to the early patents of the United States, as will appear from the following explanation:

In the official Patent Office publications, issued by the Government prior to the year 1843, the publication of the claims was omitted; while, for a considerable period, the JOURNAL published an abstract of the specifications and the claims in full. The JOURNAL, consequently, is the only source at present available for reference to the specifications and claims of patents issued by the United States, from 1828 to 1842, inclusive. The JOURNAL can also be used, in place of the official publications, as a source of reference to the patents granted during the period 1826-1859 in which the patent lists were published therein.

The complete file of the JOURNAL embraces *The Franklin Journal*, 1826-1827, and the JOURNAL OF THE FRANKLIN INSTITUTE, 1828 to the present time, 199 volumes in all, with a General Index, 1826 to 1885, and three decennial volumes covering the years 1886 to 1915, inclusive.

In its present form, the JOURNAL is an octavo of about 150 pages. It is published monthly, the twelve impressions being divided into two volumes yearly—January to June and July to December, each separately paged, and supplied with title-page and index.

INSTRUCTION

The first Board of Managers of the Institute provided for the establishment of a standing Committee on Instruction, charged with the duty of directing its educational work.

This committee was appointed on March 4, 1824, and speedily perfected plans for systematic instruction by means of lectures and demonstrations. Professorships in chemistry, in natural philosophy and mechanics, and in architecture were established and filled by the election of capable instructors.

Provision was next made for the instruction of mechanics and apprentices and those engaged in the useful trades, and early in the fall of 1824 a school of mechanical and architectural drawing was established. This experiment seems to have been crowned with complete success; and the managers proceeded to establish another school, in which should be taught "all the useful branches of English literature and the ancient and modern languages. This project was realized in 1826. In 1827 over three hundred scholars were upon its

roll. It was the model upon which the Central High School, shortly afterwards established by the city as part of the public school system, was patterned. The drawing school was continued, and maintained an uninterrupted existence for ninety-nine years. Its leading feature—that of training pupils for actual work in shop and office—was always rigorously preserved.

Twenty-seven years ago classes in mathematics were established; these later became a part of the school of machine design. Instruction in naval architecture was first given in October, 1899.

All departments of instruction were united in the year 1910 and known as the School of Mechanic Arts.

For a period of ninety-nine years the Institute afforded educational training of a high order to many thousands of young men who, judging by many notable successes, benefited greatly by such training. The educational function of the Federal Government, State and City having been extended to cover fully the Institute's field of effort in vocational training, the work of its School has been suspended.

LECTURES

These have always occupied a prominent place in the scheme of the Institute's work, from the beginning to the present.

The first course was given in the old Academy Building, on Fourth Street, near Arch, owned by the University of Pennsylvania, the use of which for this purpose was granted by the trustees; and the work of the professors was ably supplemented by a corps of volunteer lecturers from the membership of the Institute. A little later, the Institute rented the lower floor of the old Carpenter's Hall for this purpose, and finally, on the completion and occupancy of the hall, the lectures were held in its own lecture room.

For many years the lectures were of the nature of regular courses on architecture, mechanics, physics, and chemistry, varied of course from year to year, but following generally the plan of graded or consecutive instruction, as in schools and colleges. This system, however, though for a long period admirably useful in meeting the needs of the public, was found in time to be gradually outgrowing its usefulness. Lecture courses on scientific themes, which for years had been practically preëmpted by The Franklin Institute, in time were made attractive features in the schools and colleges, and the popular science lecturer became a conspicuous figure on the public lecture platform. And so it came about, naturally, that the Committee on Instruction found it advantageous gradually to modify its plans to adapt them to the changes of the times. For a number of years, accordingly, the character of the Institute lectures has departed widely from the old-time pattern. The object at present most conspicuously kept in view in the selection of the lectures is to give the members of the Institute the advantage of having presented to them the latest advances in the useful arts and the sciences baring thereon; and, to this end, the committee's efforts each year are directed to the purpose of securing the services of men of eminence in their respective fields of labor, who are invited to select their own themes. Since its foundation, The Franklin Institute has given free to the public thousands of lectures by distinguished scientists and technologists on scientific and

technological subjects in addition to numerous popular and illustrated addresses on subjects of immediate interest to the public and germane to the topics of the day.

MEETINGS

General meetings of the Institute's entire membership are held once each month, except during the summer. At these meetings great inventions and discoveries, important engineering projects, and notable achievements in all fields of scientific progress are presented, exhibited or discussed. Many of the epoch-making inventions have been shown in their experimental stages at these meetings—as the phonograph, the electric light, the typewriter, liquid air apparatus, machine telegraphy, etc.

EXHIBITIONS

As a means of promoting the mechanics arts, the holding of exhibitions was highly favored by the founders, and in this field of activity the Institute, for many years, was conspicuously prominent.

The first exhibition of American manufactures was held in October, 1824, in Carpenters' Hall.

This, it should be remembered to the credit of the Institute, was the first of the kind to be undertaken in this country.

The exhibitions of the Institute were held yearly or biennially, down to the year 1858. Many of the earlier events took place in the old Masonic Hall, on Chestnut Street, above Seventh, and in a temporary annex thereto; and the more recent ones in the one-time famous Museum Building, at Ninth and Sansom Streets, the destruction of which by fire, in the year 1850, made it necessary for the managers, for several years, to adapt themselves to less desirable quarters, and finally to discontinue the exhibitions for a time for want of a centrally located building suitable for the purpose.

In the year 1874 occurred the fiftieth anniversary of The Franklin Institute, and a fortunate circumstance enabled the managers to signalize the event by holding an exhibition, which proved from every point of view an eminently successful one. The circumstance spoken of was the fact that the Pennsylvania Railroad Company placed at the service of the Institute, for exhibition purposes, the old building at Thirteenth and Market Streets, for many years occupied as a freight station. Over 268,000 visitors attended this exhibition.

Successful, however, as was the exhibition of 1874, it was eclipsed in brilliancy, and in value from the educational and technical standpoint, by that of 1884, which will ever be memorable in the annals of The Franklin Institute. This was the Electrical Exhibition, held in the autumn of that year, under the direction of the Institute, and which by Act of Congress, approved February 26, 1883, was made international in character. It was the first exhibition in America devoted exclusively to the electrical arts.

In 1885 the Novelties Exhibition was held in the building erected for the electrical exhibition.

No further exhibitions have been held since that time, though the Institute coöperated with the Commercial Museum of Philadelphia in the management of the National Export Exposition of 1899.

MODELS AND HISTORICAL APPARATUS

This collection includes the electrical machine used by Dr. Franklin in his experiments in Philadelphia, his imposing stone and table for dressing type; Dr. Priestley's air pump, brought by him to America in 1794; odometre used by Dr. Franklin when postmaster general of the colonies and by Thomas Jefferson; George M. Phelps' printing telegraph apparatus; magneto-electric machine made by Joseph Saxton and exhibited by him at the meeting of the British Association for the Advancement of Science in 1833; Oertling balance made about 1840; model of Oliver Evans' first high-pressure steam engine, made by Rush and Muhlenberg; model of George Stephenson's "No. 1" locomotive built for the Stockton's and Darlington Railroad.

There are also numerous examples of metering devices for water, air, gas and electricity; photographic apparatus; typing and calculating machines and philosophical apparatus, the whole illustrative of the genius for discovery and invention that have made the past century notable in the history of science and its application in the industries.

HISTORICAL EXTRACTS

(CHRONOLOGICALLY STATED)

About a century ago there lived in Philadelphia two young men who independently conceived the idea of founding an American institution for promoting knowledge of physical science and its diffusion in the arts and industries. One of them was Samuel V. Merrick, then not quite twenty-one years old, and the other was Prof. William H. Keating of the University of Pennsylvania.

Mr. Merrick issued several calls for meetings for the consideration of the project, but no one attended.

Professor Keating had completed his scientific training in France and Switzerland and had returned to the United States full of zeal for the diffusion of science applied to agriculture and the mechanic arts. He was immediately appointed to the newly created chair of Chemistry in its application to Agriculture and the Mechanic Arts, at the University of Pennsylvania and while thus engaged sought to interest his friends and others in his plans for a scientific and technical society. Mr. Merrick and Prof. Keating comparing notes agreed to make another effort to hold another meeting for purposes they both had in mind.

Six gentlemen attended this meeting and a committee was appointed to draft a plan of organization, constitution, etc.

A small meeting was held, a plan approved, and Mr. Merrick and Prof. Keating set about to carry it into execution.

Four of the Committee selected from 1200 to 1600 names of citizens from the City Directory and invited them to attend another meeting to be held at the County court house at Sixth and Chestnut Streets, Philadelphia, on the evening of February 5, 1824.

The court house was filled to overflowing and from this meeting dates the founding of The Franklin Institute.

1824, February 5. First public meeting held in the County court house, Sixth and Chestnut Streets, for the purpose of organizing The Franklin Institute. A constitution was adopted and a day fixed for the election of officers.

March 4. Committee on Lectures appointed and the Chair of Mineralogy and Chemistry established.

March 30. An act to incorporate The Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts passed by the Legislature and signed by the Governor.

Dr. William H. Keating, Professor of Mineralogy and Chemistry, delivered the first lecture of the first course in the Academy Building, Fourth Street, below Arch, in April.

A Drawing School for members' sons and apprentices was opened in October. John Haviland, professor in charge, assisted by Hugh Bridport, artist and painter of miniatures.

October 18, 19 and 20, first exhibition of products of American industry held in Carpenters' Hall. Thirty premiums were offered for specimens of

blister steel, bar iron, broadcloths, domestic carpetings, etc. Three hundred exhibits; ten silver medals and two bronze medals were awarded.

1825, April 4. A Mathematical School for members, their sons and apprentices was opened under the direction of Mr. Levi Fletcher.

June 8. This day at high 12 o'clock The Corner Stone of the Hall of The Franklin Institute was laid in ancient and Masonic form by the Grand Lodge of Pennsylvania in the presence of the Society. After the appropriate ceremonies had been performed by the Grand Master, prayers were offered up by the Rev. C. G. Potts, Grand Chaplain. The Grand Treasurer deposited in the cavity of the Stone, a glass cylinder hermetically sealed containing:

The constitution and by-laws of The Franklin Institute with their first annual report and list of Members, etc.

Medal of William Penn and the Indian chief, sitting under a tree smoking the calumet of peace, on the reverse the allseeing eye, inscribed "Let us look to the Most high who blessed our fathers with peace."

Head of Washington inscribed "George Washington: Commission resigned—Presidency relinquished—1797."

A Silver Medal, with the head of James Munroe, Late President of the United States. On reverse: The Hands of an American officer and an Indian Chief grasped, under the Calumet of Peace. Motto: "Peace and Friendship."

Three Coins of the United States, 1825.

A parchment Scroll on which was inscribed the following:

On the 8th day of June 1825 A. D. 5825 A L and of the independence of these United States the forty-ninth—this Corner Stone of the Hall of The Franklin Institute of the State of Pennsylvania for the promotion of the Mechanics Arts was laid in Ancient and Masonic Form by the Grand Lodge of Pennsylvania.

James Harper, Jr., R. W. G. M.

Thomas Kittera, R. W. D. G. M.

Samuel Badger, R. W. S. G. W.

Michael Nesbit, R. W. J. G. W.

Samuel H. Thomas, R. W. G. S.

Robert Toland, R. W. G. T.

The Franklin Institute was founded the 5th day of February, A. D. 1824, and incorporated the 30th day of March, 1824.

Names of the officers of the year 1825:

President, James Ronaldson.

Vice-presidents, Math. Carey, I. Lukens.

Recording Secretary, W. Strickland; Corresponding Secretary, P. A. Browne.

Treasurer, Thos. Fletcher.

Managers, Paul Beck, Jr., Jno. Harrison, Saml. R. Wood, William H. Keating, Jno. Haviland, Samuel V. Merrick, William Abbot, Jno. D. Eisenhut, Jno. P. Wetheril, James Clarke, Abm. Miller, Jas. Harper, Jr., Adam Ramage, Harvey Lewis, R. M. Patterson, James McAlpin, Wm. Fry, Wm. Kneass, Joseph Donaldson, J. B. Garrigues, Wm. S. Warder, Lloyd Miflin, A. G. Ralston.

Building Committee of the Hall:

Peter A. Browne, S. R. Wood, S. V. Merrick, James McAlpin, J. B. Garrigues.

Architect, Jno. Haviland.

M. Carpenter, Jas. Clarke.

M. Marble Mason, John Struthers.

M. Bricklayer, Daniel Groves.

The assembly was then addressed by P. A. Browne, Esq., and Adjourned.

(From the minutes of The Franklin Institute, vol. A.)

Dr. Thomas P. Jones appointed Professor of Mechanics and Natural Philosophy.

October 6, 7 and 8, second exhibition of American manufactures held in Masonic Hall, Chestnut Street, west of Seventh. The number of articles exhibited far exceeded that of the previous year. Eighty-five premiums were offered. Six hundred and ninety-nine articles are listed in the catalogue of exhibits.

1826, January. First number of THE FRANKLIN JOURNAL was issued under the editorial management of Dr. Thomas P. Jones. In addition to his position as Editor, Dr. Jones also acted as Recording Secretary of the Institute and Curator of its collections. April 12, 1828, he was appointed Superintendent of the U. S. Patent Office.

It extended its educational efforts by establishing on April 6 a High School in which Mathematics, Drawing, Geography, History, Latin, Greek, French, Spanish and German were taught. Three hundred and four pupils were in attendance in October, 300 were studying English, 153 French, 105 Latin, 35 Greek, 45 Spanish, 20 German, 300 Elocution, 240 Geography, 231 Drawing, and all of them Mathematics. The School was continued until 1832 and was the predecessor of the Central High School.

October 3, 4, 5, 6, third exhibition of American manufactures was held in Masonic Hall. Silver medals were awarded for soft iron castings, flint glass ware, china from American materials, skirting and japanned leather, white lead, etc. Thirty-four thousand visitors.

1827. Select Committee on Dry Docks made a lengthy illustrated report on the plans submitted by Commodore James Barron, U. S. N., and Captain Thomas Caldwell, giving costs, methods of operation, etc.

October 4, 5, 6 and 8, fourth exhibition of American manufactures held in Masonic Hall. Sixty-two premiums were offered. John L. Wilson, a pupil of the High School of The Franklin Institute, was awarded a silver medal for his map of South America which was exhibited at that time.

1828, October 8, 9, 10 and 11, fifth annual exhibition of American manufactures held in Masonic Hall. Forty-five premiums were offered. Awards were made for specimens of annealed cast iron (the first attempt in this country to anneal iron for general purposes), for the best porcelain made in the United States, for calicos or prints, etc. Robert P. Warner, a pupil of the High School, was awarded a silver medal for his drawing of an air pump.

1829. Committee appointed to investigate the efficiency of moving water as a motive power. The report of the Committee, containing much information, and the results obtained from seven hundred experiments, the effect of each of which was submitted to minute calculation, appeared in the JOURNAL

of the Institute for 1831 and 1832. The second portion of the report dealing chiefly with overshot wheels, undershot wheels, and breast wheels was published in March, April, May, June and July, 1841.

1830, September 14 to 19 inclusive, sixth exhibition of American manufactures held in Masonic Hall. The exhibition distinguished itself from all preceding ones by the great excellence of the articles deposited. Thirty-seven premiums were proposed, but three only were adjudged to be due; the first for the best stock or standing vice, the second for a cooking stove, and the third to the maker of a vegetable oil that would answer as a substitute for olive oil. The exhibit of American silk was most noteworthy.

Because of the numerous accidents in steamboats, a committee of five members was appointed to inquire and report whether it be expedient for the Board to institute an investigation into the probable causes of these accidents and the proper remedy to be applied to prevent their recurrence. The appointment of a large committee was suggested to inquire into the probable causes of the explosions of boilers, the best way to obviate the recurrence of these evils, and to limit the extent of their injurious influence. Seventeen members were appointed to undertake this investigation, including Dr. Thomas P. Jones, Professor Walter R. Johnson, Matthias W. Baldwin, Frederick Graff and Isaiah Lukens. While the work of the Committee was still in progress, the Secretary of the Treasury of the United States requested that further extension of the Institute's inquiry include the prevention of steam boiler explosions. This led naturally to an investigation of the strength of materials, and the Committee devised apparatus of various forms for the testing of metals, building materials, steam boilers, etc. The correspondence and documents collected by the Committee with its extensive report appeared in the issues of the *JOURNAL* of the Institute for 1831, 1832, 1833 and 1834. The report of experiments on the prevention of boiler explosions was published in January, February, March, April and May, 1836, and the results of the investigations on the strength of materials with numerous illustrations and detailed descriptions of original apparatus appeared in the *JOURNAL* February to August, 1837.

1831, October 4 to 8 inclusive, seventh exhibition of domestic manufactures held in Masonic Hall. Visitors exceeded forty thousand. Eighty-nine premiums were proposed of which fifteen were adjudged due. Fifteen additional premiums were recommended. A silver medal and one hundred dollars were awarded for a cast iron cooking stove for anthracite coal. Five hundred and forty-two articles were exhibited.

1832. Commenced an investigation into the resources of the Commonwealth considered in relation to its industry and manufactures, an occasion which led to a geological survey of the State.

Walter R. Johnson presented a notable communication on "The Strength of Cylindrical Steam Boilers." The results given are based on the extensive series of experiments made by the Institute's Committee on the Explosion of Steam Boilers.

1833. The Institute was requested by the State Legislature to examine and report upon a bill relating to weights and measures and admeasurement reported to the House of Representatives June 26, 1833. A special committee

of seventeen was appointed to consider the matter. The extensive report which included a detailed statement on the weights and measures of France, England and the United States, as well as an authentication of the Troy pound used in the United States Mint, appeared in the *JOURNAL* for November, 1833, and February to July inclusive, 1834. The Governor requested the Committee to superintend the construction of the Standards.

The present laws of the State are based on the recommendations made as a result of this investigation.

October 1 to 5 inclusive, eighth exhibition of domestic manufactures held in Masonic Hall. Over seven hundred exhibits. Fifty thousand visitors. Silver medals were awarded for lamps, pianos, rifles, hardware, carpets, cotton and woolen goods, etc.

1834. Joint committee of The Franklin Institute and the American Philosophical Society first began systematic meteorological observations in aid of agricultural and other interests. A circular issued by the Committee requested observers to note the direction of the wind; to collect all information concerning storms—their width, direction, velocity, etc.; and the beginning and end of all rains. Detailed instructions were given for taking the "dew point." The Committee consisted of eight members, three from the American Philosophical Society and five from The Franklin Institute, Dr. James P. Espy acting as Chairman. This Committee continued its work successfully until 1838, when that portion appointed by the Philosophical Society were discharged by that body and the Board of Managers at once appointed a standing Committee on Meteorology to continue the collection of the data. By an Act of the Legislature, passed March 31, 1837, two thousand dollars were appropriated with the further sum of one thousand dollars for each of the two years next ensuing, for the purpose of promoting the improvement of meteorological science, and the furnishing of each county of this commonwealth with the necessary instruments for the observation of such atmospheric changes and phenomena as may be useful for the promotion of knowledge in the science of meteorology.

1835, October 7 to 10 inclusive, ninth exhibition of domestic manufactures held in Masonic Hall. Awards were made for samples of muslin, chintz prints, ginghams, venetian carpeting, straw bonnets, watch dials, water and oil colors, pearl work, leather, porcelain, etc.

1837. The general interest created by the Institute's work gave rise to a movement for the establishment of a school of arts, and a public lot for the erection of buildings was offered by City Councils on High (Market) Street, west of the Schuylkill River. An application for an appropriation from the State failed to pass the Legislature, and after further consideration by the Institute's Committee it was found inexpedient to organize any school at this time, and the plan was abandoned. The movement resulted later in the founding of the Department of Science of the University of Pennsylvania.

1838, November 6 to 17 inclusive, tenth exhibition of domestic manufactures held in Masonic Hall. The profits to the Institute on the present occasion were greater than was ever before realized, notwithstanding the heavy expenses incurred in making preparations. Awards were made for cotton and woolen goods, silks, straw goods, specimens of iron and steel, cutlery, philosophical

apparatus, harness, etc. A chandelier with thirty-eight lights made for the Senate Chamber of the State of Mississippi was one of the striking exhibits.

1839. The JOURNAL for November, 1839, contained a full translation by Professor John F. Frazer of the paper "Practical Description of the Process Called the Daguerreotype, which Consists in the Spontaneous Reproduction of the Images of Natural Objects in the Camera Obscura, not with Their Colours, but with Great Delicacy in the Gradation of Tints" presented to the French Academy by Daguerre.

1840. A detailed review of Dr. Alexander Dallas Bache's report on education in Europe to the Trustees of Girard College for Orphans appeared in the JOURNAL for January (the report, covering nearly seven hundred pages, was made for use in connection with the organization of Girard College, of which Dr. Bache was President).

October 7 to 21 inclusive, eleventh exhibition of domestic manufactures held in Masonic Hall. Silver medals were awarded for cotton and woolen goods, specimens of iron and steel, hardware and cutlery, a cooking stove, a piano, wall paper, etc. Over one thousand exhibits.

October 18 to 31 inclusive, twelfth exhibition of American manufactures held in the Philadelphia Museum Building, northeast corner of Ninth and Sansom Street and Welch's Olympic Circus, Walnut Street west of Eighth. No exhibition passed this in point of quality. About nine hundred exhibits.

1843. A request from City Councils for information on the best modes of paving highways. This question was referred to the Committee on Science and the Arts and a subcommittee of eight members was at once appointed. A voluminous report was presented, which gave careful consideration to all phases of the subject. The best construction of asphalt, wood and stone pavements was described. Pavements especially suitable to Philadelphia were noted, as well as plans and specifications, and superintendence and manner of executing the work. The report was accompanied by a map of Philadelphia showing the soils and drainage between the Delaware River and the Schuylkill River, and South Street on the South and Vine Street on the North.

October 17 to 28 inclusive, thirteenth exhibition of American manufactures held in the Philadelphia Museum Building. Silver medals were awarded for printed cotton goods, longcloths, gentlemen's boots and slippers, artificial teeth, etc.

1844, October 14 to 30, fourteenth exhibition of American manufactures held in the Philadelphia Museum Building. Fifty-nine silver medals were awarded for cotton and woolen goods, hardware and cutlery, glass ware, etc., and one hundred and fifty-four certificates of Honorable Mention.

1845, October 21 to November 1 inclusive, fifteenth exhibition of American manufactures held in the Philadelphia Museum Building. Fifty-one first-class premiums were recommended, two hundred and sixteen awards in all. Seventy thousand visitors.

1846, October 20 to 31 inclusive, sixteenth exhibition held in the Philadelphia Museum Building. Silver medals were awarded for gloves, specimens of rolled iron, lamps and gas fixtures, wire rope, coach harness, window shades, musical instruments, etc.

1847, October 19 to 30 inclusive, seventeenth exhibition of American manufactures held in the Philadelphia Museum Building. Silver medals were awarded for blankets, shawls, woolen and worsted yarn, bars of iron, the chandelier made for the Opera House at New York, machinery, glass ware, book binders' dies, chemicals, etc. Seventeen hundred and forty-two exhibits.

1848, October 17 to 28 inclusive, eighteenth exhibition of American manufactures held in the Philadelphia Museum Building. Silver medals were awarded for cotton and woolen goods, carpets, specimens of iron, lamps and gas fixtures, hardware, glass ware, furs, chemicals, etc. A first premium was awarded for a copy of the Webster dictionary, designed as a present to the Queen of England. Seventeen hundred and fifty-one exhibits.

1849, October 16 to 27 inclusive, nineteenth exhibition of American manufactures, held in the Philadelphia Museum Building. Silver medals were again awarded for products made from cotton and woolen materials, hardware and cutlery, also for Daguerreotypes, Talbottypes and Hyalotypes, boots and shoes, chemicals, needlework, etc.

1850. The School of Design for Women was founded by the Institute. Mrs. Sarah Worthington Peter, first Directress. Classes in art and design for women had been conducted by Mrs. Peter in her home, Number 327 South Third Street, for six years prior to the establishment of the School by the Institute.

In 1851 a room was leased at Number 70 Walnut Street (West of Third), where the School began as an independent institution under the direction of a special committee appointed by the Board of Managers of the Institute. This arrangement continued for two years when, in the spring of 1853, control was transferred to a separate organization, and Elliott Cresson, one of the Institute's benefactors, became the President.

October 15 to 26 inclusive, twentieth exhibition of American manufactures held in the Philadelphia Museum Building. Silver medals were awarded for tin ware, dental materials, chemicals, leather, saddlery and harness, philosophical instruments, etc. Nine hundred and fifty exhibits.

1851, October 21 to November 1, twenty-first exhibition of American manufactures held in the Philadelphia Museum Building. Awards were made for agricultural implements, carpetings, hardware, cabinet ware, lamps and gas fixtures, leather, chemicals, etc.

1852, October 19 to 30 inclusive, twenty-second exhibition of American manufactures held in the Philadelphia Museum Building. One special award, four gold medals, five recall first premiums (silver medals), eighty-six first premiums, fifty-two second premiums and thirty-eight third premiums were awarded. Ten exhibits were referred to the Committee on Science and the Arts. Twelve hundred exhibitors, one hundred thousand visitors. In number of exhibitors and articles displayed, as well as their beauty, novelty and value this exhibition was superior to any previous one held by the Institute.

1853, October 18 to November 3 inclusive, twenty-third exhibition of American manufactures held in the Philadelphia Museum Building. One hundred and eighty-six awards were made. Over eight hundred exhibits.

1854, November 14 to December 2, inclusive, twenty-fourth exhibition of American manufactures held in Dr. David Jayne's granite building on Dock

YEAR BOOK OF

... were offered for perfumery and soaps, straw goods, chemicals, leather, dental materials, surgical instruments.

... December 11 to 29 inclusive, twenty-fifth exhibition of American ... in Dr. Jayne's building on Dock Street. Silver medals ... for specimens of rolled iron, hardware, stoves and heaters, ... and gas fixtures, silver ware and jewelry, cotton and woolen ... etc. 1226 exhibits.

... October 15 to November 13, twenty-sixth annual exhibition of American ... in the State Armory Building and adjacent grounds (Sixth and Seventh Streets). Awards were made for musical instruments, books, ... type and materials, boots and shoes, needlework, coachwork, ... philosophical apparatus, glass and china, lamps and gas fixtures, ... etc. A special pamphlet report on the sewing machines deposited ... was published in 1859.

... The Guardians of the Poor requested the Institute to communicate ... the most efficient means of protecting the Alms House Buildings ... lightning.

A subcommittee of the Committee on Science and the Arts, to whom the ... was referred, made a survey of the grounds and buildings and recommended the installation of a system of lightning rods, properly connected ... grounded. Detailed directions were given for making this installation.

At the Stated Meeting of the Institute held April 21, 1864, President William Sellers read a paper on a System of Screw Threads and Nuts. He pointed out the importance of a uniform system of screw threads, bolt-heads and nuts and offered suggestions for establishing such a system. Tables, diagrams and formulæ were submitted and comparisons were made with the English system. After a discussion it was voted to send copies of Mr. Seller's paper to other societies for consideration and approval. A special committee was appointed to investigate the question of a proper system of screw threads, bolt-heads and nuts, to be recommended by the Institute, for the general adoption by American engineers. The committee presented its report in December and recommended the adoption of certain forms and proportions. Copies of the report and resolutions were forwarded to the various departments of the United States Government and to the Superintendents and Master Mechanics of railroad companies requesting them to use their influence to promote the adoption of a uniform system of screw threads, bolt-heads, and nuts, by requiring all builders under any new contracts to conform to the proportions recommended. Copies were also sent to Mechanical and Engineering Associations and Institutions, machine and engine shops throughout the country with a request that they use their influence in favor of the proposed system. The Sellers or Franklin Institute system was adopted by the United States Government in 1868, in the following year the Pennsylvania Railroad Company ordered a set of gauges of the new form and adopted it and in 1872 the Master Car Builders' Association recommended the system as a standard.

1869. Organized the Expedition to observe the Solar Eclipse at Mount Pleasant, Iowa, on August seventh. A party of volunteers, twenty in number, under the direction of Henry Morton, attended to the various duties in connection with the observation. The telescopes were borrowed and the transportation

for the party and equipment was furnished by the railroad companies. The first account of the work of the members of this expedition appears in the *JOURNAL* of the Institute for September, 1869. (Vol. 88, p. 200.)

A committee of three was appointed to consider the subject of memorializing Congress in reference to an exposition of Arts and Manufactures on the centennial anniversary of American Independence, to be held in the city of Philadelphia. This action resulted in the appointment of a special committee of five to bring the matter to the attention of Select and Common Councils and request that they memorialize Congress on the subject. A joint committee was organized, consisting of nine members from each chamber of Councils, three members from each House of the Legislature, and five representatives of the Institute, for the purpose of obtaining such aid as would make such an exhibition truly international in its character.

The efforts of this Committee resulted in the passage, by Congress, on March 3, 1871, of An Act to Provide for celebrating the 100th Anniversary of American Independence by holding an international Exhibition of Arts, Manufactures and Products of the Soil and Mine in the City of Philadelphia, and the State of Pennsylvania in the year 1876.

1871. The Committee appointed June 21, 1871, to examine into the modes of determining the horse-power of steam boilers presented a preliminary report which appeared in the *JOURNAL* for August, 1871. The concluding report was published in August, 1872, and was fully discussed at the Stated Meeting of the Institute held in October, 1872 (J. F. I., December, 1872, vol. 94, p. 377). It was voted to increase the membership of the Committee having charge of the experiments and have the investigation continued. A majority and minority report were presented to the Stated Meeting of the Institute on November 19, 1873, and appear in the *JOURNAL* for December, 1873. (Vol. 96, p. 396.)

1873. At the Stated Meeting of the Institute held February 19, 1873, the suggestions made by Professor J. P. Lesley in a letter to the Governor of Pennsylvania dated February 1 (J. F. I., Vol. 95, p. 194) urging the establishment of a geological survey of the state were approved. In his letter Professor Lesley called attention to the needs and advantages of a survey, the importance of accurate geological maps of the state and submitted suggestions for a complete working corps for the operations of the various departments of the survey. He estimated that the annual expense for personnel, laboratory, traveling expenses, instruments, publications and printing would be \$47,000.

On May 14, 1874, the Legislature passed a bill providing for a state survey, which was signed by the Governor on the same day. The bill included an appropriation of \$35,000 per year for three years. (This was the beginning of the Second Geological Survey of Pennsylvania.)

The April issue of the *JOURNAL* contains a report of the Committee on the Causes of Conflagrations and the Methods of their Prevention, with an exhaustive paper on "The Light Petroleum Oils; considered as to their safety or danger, in various domestic uses" prepared by Dr. William H. Wahl for the use of the Committee.

At the Stated Meeting of the Institute held March 19, 1873, it was resolved, to recommend and petition the legislature to pass an act or acts embodying the following points: To appoint a competent commission to investigate and

it can be ascertained which oils or
which are unsafe. To make it a
it knowingly use any oil or
in case of death
will be liable to

seventy-seventh exhibition of
Railroad Station, Thirteenth
Vanamaker Store). Held to
the Institute. Number of exhibi-
missions—two hundred and sixty-
Two hundred and one silver
medals and two hundred and
Mention were awarded.

June 5 requested the Mayor to appoint
practical engineers to be selected from
by the Board of Managers of The
with the Chief Engineer of the Water
the entire subject of the present and future
The Commission organized on June 29 and
the various pumping stations and reservoirs.
the Wissahickon valley, the valley of the
Schuylkill River and the Delaware River above tide,
Easton and the Water Gap. The report of the
to Councils before the close of the year and
recommendations for the improvement of the present water
for the Centennial year. For future supply the
conduct seemed to be reasonably practicable. Abstracts
in the JOURNAL for November and Decem-

Board of Managers learned of the measures being
Museum of Industrial Art similar to the South Kensington
and gave the movement their endorsement. In December
extended to the Institute to choose one of the trustees of
the following year Mr. J. B. Knight, then
Institute was chosen to act in that capacity. For ten years
the management of the Museum.

A resolution passed at the meeting of the Institute held May 7,
to give expression of the views
of the waters of the Schuylkill River
the eastern end of the Girard Avenue bridge.
the issue of the JOURNAL for August.
called to the advantage which would
the construction of an intercepting
from Manayunk or beyond,
the densely populated portions of the City

June 7, the Mayor appointed a

Board of Experts consisting of one civil engineer, one mechanical engineer and one hydraulic engineer selected from nine names submitted by the American Society of Civil Engineers and the Institute, and the Chief Engineer of the Water Department to "report to Councils the methods pursued in the Water Department, together with their recommendations of what should be done for the present and future supply of the City, with such itemized estimates as will enable the cost to be determined." The preliminary report of this Commission was presented to Councils on October 14, 1882, and appeared in the *JOURNAL* of the Institute for April, 1883. It contained recommendations for the installation of machinery and apparatus in the several pumping stations, the completion and extension of reservoirs and the management of the stations. The final report was transmitted to Councils on April 5, 1883 (*J. F. I.*, Vol. 116, p. 321). Special attention was given to the future supply of the City and the reduction of waste. The use of meters for factories and large public buildings was suggested.

A paper on the Prevention of Fires in Theatres was read at the Stated Meeting held June 21 by Charles J. Hexamer, C. E., (*J. F. I.*, Vol. 114, pp. 125, 211). At the close of the discussion which followed the reading of the paper, it was voted to appoint a committee to investigate the subject of the prevention of fires in theatres. The report of this committee was presented to the Stated Meeting of the Institute on April 18, 1883, and printed in the *JOURNAL* for June (Vol. 115, p. 428). It contains much information on theatre fires, the hazards of artificial light, heating apparatus, fireworks, the use of paper wads in guns, the situation of the necessary work shops, paint lofts and spontaneous combustion. Considerable attention is given to the fire-proof drop curtain, and after having obtained information from many sources the committee expressed the opinion that woven asbestos cloth is most satisfactory. The report contains thirty-eight recommendations intended to make places of amusement more safe, nearly all of which have since been adopted.

1884, September 2 to October 11. The International Electrical Exhibition, held in the Pennsylvania Railroad Station at 32nd and Market Streets and a building especially erected at the northwest corner of 32nd Street and Lancaster Avenue.

Without Federal or State aid the Institute held the first great electrical exhibition in this country. Total number of paid admissions, 282,779; receipts from sale of tickets, \$98,639.70. 216 exhibitors.

By an act of congress the United States Electrical Commission was created for the purpose of conducting a national conference of electricians. This commission issued invitations to a large number of scientific gentlemen, both foreign and American, who assembled in conference on September 8 and continued their deliberations for six days.

During and immediately after the exhibition the most complete and extended series of tests attempted to that time were made to determine the characteristics of all the more important types of electrical apparatus and appliances then commercially used. The results of these tests were published in the *JOURNAL* and in pamphlet form during 1885 and 1886 as the Reports of the Examiners.

The organization of the American Institute of Electrical Engineers this year resulted from the holding of the electrical exhibition and the international conference of electricians.

1885, September 15 to October 31. The Novelties Exhibition held in the buildings erected for the use of the electrical exhibition; this was the twenty-ninth exhibition and was devoted to novelties in American Manufactures. 375 exhibitors.

Awards of medals and diplomas were made for articles of novel or intrinsic merit.

1886. At the Stated Meeting of the Institute held October 20, 1886, it was resolved, that the subject of organizing a State Weather Service be referred to a special committee, to be appointed by the President, with the request to report a plan for the same, if possible, to the Stated Meeting of the Institute in November.

On December 15 the special committee presented its report and recommended immediate organization of a "State Weather Service" with a volunteer force of observers; that the coöperation of railroad, telegraph and telephone companies and newspapers be solicited; that all institutions of learning throughout the state be invited to take an active interest in the collection of meteorological data and the study of the science; that an effort be made to secure an appropriation of \$3000 from the state, for the purchase of instruments and for the publication of the results of observations in tabulated form.

The offer of the Chief Signal Officer to furnish a member of the Signal Corps to assist in the work was accepted.

An Act to establish a State Weather Service was at once drafted and passed by the Legislature and the first Summary of Meteorological Reports giving the results of observations made in September appeared in October, 1887.

The service was in operation until May, 1891, when the State discontinued the appropriation.

1889. President Joseph M. Wilson, at the Stated Meeting of the Institute held November 20, made some remarks upon his observations of trade schools in France and England, having been charged with the task of investigating the organization and mode of operation of such institutions on behalf of the projected school of Mr. A. J. Drexel, of Philadelphia.

Mr. Wilson's complete report "On Schools: with particular reference to Trade Schools," appeared in the issues of the JOURNAL February to October inclusive, 1890.

1897. The Board of Health of the City of Philadelphia requested the appointment, by The Franklin Institute, of a committee to coöperate with the Board, in considering ways and means for the abatement of the growing evils arising from the increasing use of bituminous coal within the city limits.

At the meeting of the Institute of April 21, 1897, the regular order of business was suspended and the evening was devoted to the consideration of "The Smoke Nuisance and its Regulation." The discussion was introduced by a paper giving a brief historical account of the subject and some data having especial reference to the smoke question as it affects Philadelphia.

The discussion was continued by brief addresses from eleven prominent engineers and the president of the Board of Health.

The discussion was resumed at the meeting of May 19 by ten engineers of note and the president of the Board of Health.

It was the unanimous opinion of those present at the meeting of September 15, that the frequent discharge of dense black smoke from furnaces of stationary boilers is avoidable and should not be permitted in the city and that the emission of smoke from locomotives and furnaces might be greatly reduced if the coöperation of firemen and employers were enlisted with an earnest intention to abate the nuisance. Resolutions to this effect were approved and it was directed that copies be sent to the Mayor, the President of the Board of Health and to the president of Councils. At this meeting descriptions were presented of improved furnaces and automatic stokers. The representatives of five of the leading manufacturers were present and described their apparatus illustrating their remarks with the aid of models and lantern slides.

The discussion was concluded at the meeting of October 20 when ten stokers and furnaces were described.

A detailed account of the above discussion appeared in the issues of the *JOURNAL* for June, July and December, 1897, and January and February, 1898.

1899. National Export Exposition held in conjunction with the Commercial Museum of Philadelphia.

The seventy-fifth anniversary of the founding of the Institute was observed by a series of conferences and lectures held in the Convention Hall of the exposition on October 2 to 7 inclusive.

1901. A special Committee appointed by the President to consider the advisability and feasibility of the adoption of the metric system in the United States, presented its report on February 19, 1902.

The following preambles and resolutions submitted by the Committee were unanimously adopted:

WHEREAS, It is desirable to obtain an international standard of weights and measures, also to simplify and regulate some of our existing standards; and

WHEREAS, The metric system is commendable, not only as a suitable international standard, but also for facility of computation, convenience in memorizing and simplicity of enumeration;

Resolved, That The Franklin Institute approves of any movement which will promote the universal introduction of the metric system with the least confusion and expense.

Resolved, That the national Government should enact such laws as will ensure the adoption of the metric system of weights and measures as the sole standard in its various departments as rapidly as may be consistent with the public service.

The report, discussion and important correspondence on the subject were published in the *JOURNAL* for June, July and August, 1902.

In order to promote both domestic and foreign commerce, the following preambles and resolutions were adopted at the Stated Meeting of the Institute held on December 18:

WHEREAS, Greater and cheaper transportation facilities are essential to the development of our domestic and foreign commerce;

WHEREAS, The limited appropriations made by the National Government are inadequate to meet the requirements of the country, covering only a small percentage of the approved projects;

WHEREAS, The former policy of authorizing the improvement of our waterways by private capital resulted in a marked development without material cost or risk to the general Government;

WHEREAS, Early and economical results may be secured by a partial return to this method in localities where no provision has been made for immediate improvement; therefore, be it

Resolved, That the proper department of the general Government should be empowered to authorize the improvement, by individuals or corporations, of such rivers, harbors, canals or other waterways as are not provided for under the River and Harbor or the "Sundry Civil" Bills, with authority to collect tolls, upon plans and regulations to be approved by the said department; PROVIDED, that no part of the funds for such work shall be drawn from the public treasury of the United States. Also,

WHEREAS, The commercial and industrial interests of the country have attained such magnitude as to require a more systematic organization for their regulation and development;

WHEREAS, A measure known as Senate Bill No. 738 has been introduced into Congress for the purpose of establishing a Department of Commerce and Industries; therefore, be it

Resolved, That the establishment of such a Department of Commerce and Industries has the hearty approval of The Franklin Institute, and its early inauguration is recommended.

1906. At the Stated Meeting of the Institute, held September 19, at the conclusion of the reading of a paper on "The Relations of the Government to Our Waterways" by Prof. Lewis M. Haupt, the following preamble and resolutions were unanimously adopted:

WHEREAS, It is the present established policy of the General Government to provide ample facilities for the water-borne commerce of the United States and to emancipate inter-state commerce from the obstructions imposed by tolls or restricted canals under private or corporate control,

WHEREAS, This policy has been successfully inaugurated in all parts of the country with the exception of the early canals skirting the most populous and important cities of the Atlantic seaboard, and

WHEREAS, The best interests of the country demand the early construction of capacious canals connecting the interior waters of the bays and sounds of this coast, for commercial purposes as well as for national defense, and

WHEREAS, The most important and least expensive of these links is the one connecting the waters of the Chesapeake and Delaware Bays by a canal which is less than fourteen miles in length, and which has a trunk of only nine feet in depth and sixty-six feet minimum width, in which the Government is a joint owner, and concerning which its officials and commissions have

invariably reported that it is vital for the protection of the coast, as has been demonstrated in our several wars, and

WHEREAS, Congress has again authorized the appointment of a Commission to ascertain the expense of securing control of the works and franchises of the Chesapeake and Delaware Canal with a view to the acquisition of the aforesaid canal as a free and open waterway, which Commission is to report at the coming session of Congress.

Be it therefore *Resolved*, That The Franklin Institute of Pennsylvania reaffirms its position as to the urgent necessity of enlarging our coastwise waterways, and especially the Chesapeake and Delaware Canal for commercial and strategic purposes at the earliest practicable date.

Resolved, That a Committee be appointed to present this resolution to the Commission at the public hearing to be held in this city on the 27th instant.

1912. Centenary of the Introduction of Gas as an Illuminant observed on April 18 and 19.

The Institute with the coöperation of the American Philosophical Society, the American Chemical Society and the American Gas Institute arranged a series of meetings and lectures dealing with subjects relating to gas and gas manufacture. An important feature of the celebration was a loan exhibition of models, photographs, sketches, prints, manuscripts and drawings relating to every phase of the gas industry; also specimens of gas meters, lamps and burners, gas stoves and other appliances.

1914. Conducted meeting in Philadelphia on June 3 in commemoration of the thirtieth anniversary of the International Electrical Exhibition. Addresses were made by Messrs. E. W. Rice, Charles F. Brush and Frank J. Sprague.

1915. First awards of The Franklin Medal.

1916. Format of the JOURNAL changed from 6 x 9 inches to 6½ x 9½ inches with increase in the number of reading pages.

1917. Established and maintained a recruiting and examination station for applicants for admission to the Aviation Service of the United States Army. Established School of Navigation for the United States Shipping Board. Conducted free Radio School for men of the selective draft.

1920. Published "Physics of the Air," by W. J. Humphreys, C.E., Ph.D., 665 pages, illustrations, diagrams, octavo.

1921. Received \$1,208,468.32 from the bequest of Henry W. Bartol, a life-member of the Institute, for research. "Bartol Research Foundation," established for the purpose of conducting researches relating to fundamental problems in physical science, particularly those in the field of electricity, and for the investigation of specific problems of a scientific nature which may arise in the industries.

1922, March 6 to 10 inclusive. F. W. Aston, M.A., D.Sc., F.R.S., Fellow of Trinity College, Cambridge, England, delivered a course of lectures on "Atomic Weights and Isotopes."

1923, April 9 to 13 inclusive. Sir Joseph John Thomson, O.M., F.R.S., LL.D., Ph.D., D.Sc., Master of Trinity College, Cambridge, England, delivered a series of lectures on "The Electron in Chemistry." Subsequently published in book-form, 144 pages, octavo.

1923. Laboratory for conducting the work of the Bartol Research Foundation, provided for by the reconditioning of three buildings on the Institute's property, at Nineteenth and Cherry Streets.

1924. September 17, 18, 19. Centenary celebration of the founding of The Franklin Institute and the Inauguration Exercises of the Bartol Research Foundation.

SPEAKERS AT THE CENTENARY CELEBRATION

PROFESSOR JOSEPH S. AMES
 PROFESSOR WILDER D. BANCROFT
 PROFESSOR SIR WILLIAM H. BRAGG
 PROFESSOR WILLIAM L. BRAGG
 PROFESSOR P. W. BRIDGMAN
 GENERAL JOHN J. CARTY
 PROFESSOR E. G. COKER
 DOCTOR WILLIAM D. COOLIDGE
 DIRECTOR ARTHUR L. DAY
 PROFESSOR F. G. DONNAN
 DOCTOR WILLIAM LEROY EMMET
 PROFESSOR CHARLES FABRY
 PROFESSOR F. HABER
 PROFESSOR W. J. HUMPHREYS
 PROFESSOR D. S. JACOBUS
 BRIGADIER GENERAL EDGAR JADWIN
 DOCTOR GEORGE L. KELLEY
 PROFESSOR A. E. KENNELLY
 DEAN DEXTER S. KIMBALL
 DOCTOR IRVING LANGMUIR
 DOCTOR ARTHUR D. LITTLE
 PROFESSOR C. H. MATHEWSON
 DOCTOR C. E. K. MEES
 PROFESSOR CHARLES MENDENHALL

PROFESSOR A. A. MICHELSON
 PROFESSOR DAYTON C. MILLER
 PROFESSOR W. LASH MILLER
 DOCTOR RALPH MODJESKI
 MR. DANIEL E. MORAN
 SIR CHARLES ALGERNON PARSONS
 MAJOR GENERAL MASON M. PATRICK
 DEAN HAROLD PENDER
 MR. F. W. PEEK
 DIRECTOR CHARLES L. REESE
 DOCTOR E. W. RICE
 PROFESSOR SIR ERNEST RUTHERFORD
 PROVOST EMERITUS EDGAR F. SMITH
 DOCTOR FRANK J. SPRAGUE
 MAJOR GENERAL GEORGE O. SQUIER
 PROFESSOR JULIUS STIEGLITZ
 PROFESSOR BRADLEY STOUGHTON
 PROFESSOR W. F. G. SWANN
 PROFESSOR JOHN SEALY EDWARD
 TOWNSEND
 PROFESSOR AUGUSTUS TROWBRIDGE
 MAJOR GENERAL C. C. WILLIAMS
 PROFESSOR PIETER ZEEMAN

CENTENARY CELEBRATION OF THE FOUNDING OF THE FRANKLIN INSTITUTE

AND THE INAUGURATION EXERCISES OF THE BARTOL
RESEARCH FOUNDATION

September 17, 18, 19, 1924, Philadelphia

THE COMMITTEES OF THE CENTENARY CELEBRATION

HONORARY COMMITTEE

ELIHU THOMSON, *Chairman*

NICHOLAS F. BRADY
WALTON CLARK
MORRIS L. CLOTHIER
CHARLES A. COFFIN
PIERRE S. DU PONT
THOMAS A. EDISON
SAMUEL INSULL
JOSEPH B. MCCALL
RANDAL MORGAN
WILLIAM H. NICHOLS

JOSIAH H. PENNIMAN
JOHN J. PERSHING
J. HOWARD PEW
SAMUEL REA
THEODORE W. RICHARDS
WILLIAM CAMERON SPROUL
HARRY B. THAYER
SAMUEL M. VAUCLAIN
RODMAN WANAMAKER
EDWARD WESTON

EXECUTIVE COMMITTEE

WM. C. L. EGLIN

WALTON CLARK

C. C. TUTWILER

HENRY HOWSON, *Treasurer*

GELLERT ALLEMAN, *Chairman*

PROGRAM

WEDNESDAY, SEPTEMBER 17TH

- 9.00 A.M. Assembly of Delegates and Guests at the Hall of The Franklin Institute, 15 South Seventh Street.
- 9.45 A.M. Academic Procession from the Hall of The Franklin Institute to the Walnut Street Theatre. Academic Costume is in order, but not required.
- 10.15 A.M. Invocation, Reverend Louis C. Washburn, S.T.D., Rector of Christ Church, Philadelphia.
- 10.30 A.M. Address of Welcome. The Honorable W. Freeland Kendrick, Mayor of Philadelphia. Address: President Wm. C. L. Eglin, Sc.D. Address: Professor Elihu Thomson, Ph.D., Sc.D., Honorary Chairman of the Centenary Celebration Committee of The Franklin Institute.
- 1.00 P.M. Luncheon to Delegates and Guests, the Bellevue-Stratford.
- 2.30 P.M. Sectional Meetings, The Franklin Institute, 15 South Seventh Street, the University of Pennsylvania.
- 7.30 P.M. Dinner Parties.

Street. Premiums were offered for perfumery and soaps, straw goods, chemicals, furs, saddlery and harness, leather, dental materials, surgical instruments.

1856, November 11 to 29 inclusive, twenty-fifth exhibition of American manufactures held in Dr. Jayne's building on Dock Street. Silver medals were awarded for specimens of rolled iron, hardware, stoves and heaters, cabinet ware, lamps and gas fixtures, silver ware and jewelry, cotton and woolen goods, chemicals, etc. 1226 exhibits.

1858, October 15 to November 13, twenty-sixth annual exhibition of American manufactures held in the State Armory Building and adjacent grounds (Sixteenth and Filbert Streets). Awards were made for musical instruments, books, stationery, printers' type and materials, boots and shoes, needlework, coachwork, dental materials, philosophical apparatus, glass and china, lamps and gas fixtures, machinery, etc. A special pamphlet report on the sewing machines deposited at this exhibition was published in 1859.

1863. The Guardians of the Poor requested the Institute to communicate to them the most efficient means of protecting the Alms House Buildings from lightning.

A subcommittee of the Committee on Science and the Arts, to whom the problem was referred, made a survey of the grounds and buildings and recommended the installation of a system of lightning rods, properly connected and grounded. Detailed directions were given for making this installation.

At the Stated Meeting of the Institute held April 21, 1864, President William Sellers read a paper on a System of Screw Threads and Nuts. He pointed out the importance of a uniform system of screw threads, bolt-heads and nuts and offered suggestions for establishing such a system. Tables, diagrams and formulæ were submitted and comparisons were made with the English system. After a discussion it was voted to send copies of Mr. Seller's paper to other societies for consideration and approval. A special committee was appointed to investigate the question of a proper system of screw threads, bolt-heads and nuts, to be recommended by the Institute, for the general adoption by American engineers. The committee presented its report in December and recommended the adoption of certain forms and proportions. Copies of the report and resolutions were forwarded to the various departments of the United States Government and to the Superintendents and Master Mechanics of railroad companies requesting them to use their influence to promote the adoption of a uniform system of screw threads, bolt-heads, and nuts, by requiring all builders under any new contracts to conform to the proportions recommended. Copies were also sent to Mechanical and Engineering Associations and Institutions, machine and engine shops throughout the country with a request that they use their influence in favor of the proposed system. The Sellers or Franklin Institute system was adopted by the United States Government in 1868, in the following year the Pennsylvania Railroad Company ordered a set of gauges of the new form and adopted it and in 1872 the Master Car Builders' Association recommended the system as a standard.

1869. Organized the Expedition to observe the Solar Eclipse at Mount Pleasant, Iowa, on August seventh. A party of volunteers, twenty in number, under the direction of Henry Morton, attended to the various duties in connection with the observation. The telescopes were borrowed and the transportation

for the party and equipment was furnished by the railroad companies. The first account of the work of the members of this expedition appears in the *JOURNAL* of the Institute for September, 1869. (Vol. 88, p. 200.)

A committee of three was appointed to consider the subject of memorializing Congress in reference to an exposition of Arts and Manufactures on the centennial anniversary of American Independence, to be held in the city of Philadelphia. This action resulted in the appointment of a special committee of five to bring the matter to the attention of Select and Common Councils and request that they memorialize Congress on the subject. A joint committee was organized, consisting of nine members from each chamber of Councils, three members from each House of the Legislature, and five representatives of the Institute, for the purpose of obtaining such aid as would make such an exhibition truly international in its character.

The efforts of this Committee resulted in the passage, by Congress, on March 3, 1871, of An Act to Provide for celebrating the 100th Anniversary of American Independence by holding an international Exhibition of Arts, Manufactures and Products of the Soil and Mine in the City of Philadelphia, and the State of Pennsylvania in the year 1876.

1871. The Committee appointed June 21, 1871, to examine into the modes of determining the horse-power of steam boilers presented a preliminary report which appeared in the *JOURNAL* for August, 1871. The concluding report was published in August, 1872, and was fully discussed at the Stated Meeting of the Institute held in October, 1872 (*J. F. I.*, December, 1872, vol. 94, p. 377). It was voted to increase the membership of the Committee having charge of the experiments and have the investigation continued. A majority and minority report were presented to the Stated Meeting of the Institute on November 19, 1873, and appear in the *JOURNAL* for December, 1873. (Vol. 96, p. 396.)

1873. At the Stated Meeting of the Institute held February 19, 1873, the suggestions made by Professor J. P. Lesley in a letter to the Governor of Pennsylvania dated February 1 (*J. F. I.*, Vol. 95, p. 194) urging the establishment of a geological survey of the state were approved. In his letter Professor Lesley called attention to the needs and advantages of a survey, the importance of accurate geological maps of the state and submitted suggestions for a complete working corps for the operations of the various departments of the survey. He estimated that the annual expense for personnel, laboratory, traveling expenses, instruments, publications and printing would be \$47,000.

On May 14, 1874, the Legislature passed a bill providing for a state survey, which was signed by the Governor on the same day. The bill included an appropriation of \$35,000 per year for three years. (This was the beginning of the Second Geological Survey of Pennsylvania.)

The April issue of the *JOURNAL* contains a report of the Committee on the Causes of Conflagrations and the Methods of their Prevention, with an exhaustive paper on "The Light Petroleum Oils; considered as to their safety or danger, in various domestic uses" prepared by Dr. William H. Wahl for the use of the Committee.

At the Stated Meeting of the Institute held March 19, 1873, it was resolved, to recommend and petition the legislature to pass an act or acts embodying the following points: To appoint a competent commission to investigate and

determine some satisfactory test whereby it can be ascertained which oils or compounds are safe to be used in lamps and which are unsafe. To make it a penal offence to manufacture, compound, sell or knowingly use any oil or compound that will not stand the required test, and that in case of death resulting from the same, the guilty person or persons shall be liable to conviction for manslaughter.

1874, October 6 to November 12 inclusive, twenty-seventh exhibition of American manufacturers held in the Pennsylvania Railroad Station, Thirteenth and Market Streets, Philadelphia (site of the Wanamaker Store). Held to celebrate the fiftieth year of the founding of the Institute. Number of exhibitors—twelve hundred and fifty-one, paid admissions—two hundred and sixty-seven thousand six hundred and thirty-eight. Two hundred and one silver medals, two hundred and twenty-eight bronze medals and two hundred and twenty-two certificates of Honorable Mention were awarded.

1875. An ordinance passed by Councils June 5 requested the Mayor to appoint a Commission of five scientific and practical engineers to be selected from not less than eight names recommended by the Board of Managers of The Franklin Institute, to whom in connection with the Chief Engineer of the Water Department, shall be referred the entire subject of the present and future water supply of Philadelphia. The Commission organized on June 29 and made a thorough investigation of the various pumping stations and reservoirs. Special examinations were made of the Wissahickon valley, the valley of the Perkiomen, the upper Schuylkill River and the Delaware River above tide, particularly at New Hope, Easton and the Water Gap. The report of the Commission was presented to Councils before the close of the year and contained nine recommendations for the improvement of the present water supply and special provisions for the Centennial year. For future supply the Perkiomen reservoir and conduit seemed to be reasonably practicable. Abstracts of the Commission's report appear in the *JOURNAL* for November and December, 1875 (Vol. 100, pp. 292, 368).

In September the Board of Managers learned of the measures being taken to establish a Museum of Industrial Art similar to the South Kensington Museum, London, and gave the movement their endorsement. In December an invitation was extended to the Institute to choose one of the trustees of the Museum, and in January of the following year Mr. J. B. Knight, then Secretary of the Institute, was chosen to act in that capacity. For ten years the Institute had a voice in the management of the Museum.

1882. A resolution passed at the meeting of the Institute held May 7, requested the President to appoint a committee to give expression of the views of the Institute concerning the pollution of the waters of the Schuylkill River from the entrance of sewage near the eastern end of the Girard Avenue bridge. The report of the Committee appears in the issue of the *JOURNAL* for August, 1882 (Vol. 114, p. 135). Attention is called to the advantage which would arise to the general health of the city from the construction of an intercepting sewer along the eastern banks of the Schuylkill from Manayunk or beyond, and with an outlet sufficiently below the densely populated portions of the City as not to be objectionable.

In conformity with an ordinance passed June 7, the Mayor appointed a

Board of Experts consisting of one civil engineer, one mechanical engineer and one hydraulic engineer selected from nine names submitted by the American Society of Civil Engineers and the Institute, and the Chief Engineer of the Water Department to "report to Councils the methods pursued in the Water Department, together with their recommendations of what should be done for the present and future supply of the City, with such itemized estimates as will enable the cost to be determined." The preliminary report of this Commission was presented to Councils on October 14, 1882, and appeared in the *JOURNAL* of the Institute for April, 1883. It contained recommendations for the installation of machinery and apparatus in the several pumping stations, the completion and extension of reservoirs and the management of the stations. The final report was transmitted to Councils on April 5, 1883 (*J. F. I.*, Vol. 116, p. 321). Special attention was given to the future supply of the City and the reduction of waste. The use of meters for factories and large public buildings was suggested.

A paper on the Prevention of Fires in Theatres was read at the Stated Meeting held June 21 by Charles J. Hexamer, C. E., (*J. F. I.*, Vol. 114, pp. 125, 211). At the close of the discussion which followed the reading of the paper, it was voted to appoint a committee to investigate the subject of the prevention of fires in theatres. The report of this committee was presented to the Stated Meeting of the Institute on April 18, 1883, and printed in the *JOURNAL* for June (Vol. 115, p. 428). It contains much information on theatre fires, the hazards of artificial light, heating apparatus, fireworks, the use of paper wads in guns, the situation of the necessary work shops, paint lofts and spontaneous combustion. Considerable attention is given to the fire-proof drop curtain, and after having obtained information from many sources the committee expressed the opinion that woven asbestos cloth is most satisfactory. The report contains thirty-eight recommendations intended to make places of amusement more safe, nearly all of which have since been adopted.

1884, September 2 to October 11. The International Electrical Exhibition, held in the Pennsylvania Railroad Station at 32nd and Market Streets and a building especially erected at the northwest corner of 32nd Street and Lancaster Avenue.

Without Federal or State aid the Institute held the first great electrical exhibition in this country. Total number of paid admissions, 282,779; receipts from sale of tickets, \$98,639.70. 216 exhibitors.

By an act of congress the United States Electrical Commission was created for the purpose of conducting a national conference of electricians. This commission issued invitations to a large number of scientific gentlemen, both foreign and American, who assembled in conference on September 8 and continued their deliberations for six days.

During and immediately after the exhibition the most complete and extended series of tests attempted to that time were made to determine the characteristics of all the more important types of electrical apparatus and appliances then commercially used. The results of these tests were published in the *JOURNAL* and in pamphlet form during 1885 and 1886 as the Reports of the Examiners.

determine some satisfactory test whereby it can be ascertained which oils or compounds are safe to be used in lamps and which are unsafe. To make it a penal offence to manufacture, compound, sell or knowingly use any oil or compound that will not stand the required test, and that in case of death resulting from the same, the guilty person or persons shall be liable to conviction for manslaughter.

1874, October 6 to November 12 inclusive, twenty-seventh exhibition of American manufacturers held in the Pennsylvania Railroad Station, Thirteenth and Market Streets, Philadelphia (site of the Wanamaker Store). Held to celebrate the fiftieth year of the founding of the Institute. Number of exhibitors—twelve hundred and fifty-one, paid admissions—two hundred and sixty-seven thousand six hundred and thirty-eight. Two hundred and one silver medals, two hundred and twenty-eight bronze medals and two hundred and twenty-two certificates of Honorable Mention were awarded.

1875. An ordinance passed by Councils June 5 requested the Mayor to appoint a Commission of five scientific and practical engineers to be selected from not less than eight names recommended by the Board of Managers of The Franklin Institute, to whom in connection with the Chief Engineer of the Water Department, shall be referred the entire subject of the present and future water supply of Philadelphia. The Commission organized on June 29 and made a thorough investigation of the various pumping stations and reservoirs. Special examinations were made of the Wissahickon valley, the valley of the Perkiomen, the upper Schuylkill River and the Delaware River above tide, particularly at New Hope, Easton and the Water Gap. The report of the Commission was presented to Councils before the close of the year and contained nine recommendations for the improvement of the present water supply and special provisions for the Centennial year. For future supply the Perkiomen reservoir and conduit seemed to be reasonably practicable. Abstracts of the Commission's report appear in the *JOURNAL* for November and December, 1875 (Vol. 100, pp. 292, 368).

In September the Board of Managers learned of the measures being taken to establish a Museum of Industrial Art similar to the South Kensington Museum, London, and gave the movement their endorsement. In December an invitation was extended to the Institute to choose one of the trustees of the Museum, and in January of the following year Mr. J. B. Knight, then Secretary of the Institute, was chosen to act in that capacity. For ten years the Institute had a voice in the management of the Museum.

1882. A resolution passed at the meeting of the Institute held May 7, requested the President to appoint a committee to give expression of the views of the Institute concerning the pollution of the waters of the Schuylkill River from the entrance of sewage near the eastern end of the Girard Avenue bridge. The report of the Committee appears in the issue of the *JOURNAL* for August, 1882 (Vol. 114, p. 135). Attention is called to the advantage which would arise to the general health of the city from the construction of an intercepting sewer along the eastern banks of the Schuylkill from Manayunk or beyond, and with an outlet sufficiently below the densely populated portions of the City as not to be objectionable.

In conformity with an ordinance passed June 7, the Mayor appointed a

Board of Experts consisting of one civil engineer, one mechanical engineer and one hydraulic engineer selected from nine names submitted by the American Society of Civil Engineers and the Institute, and the Chief Engineer of the Water Department to "report to Councils the methods pursued in the Water Department, together with their recommendations of what should be done for the present and future supply of the City, with such itemized estimates as will enable the cost to be determined." The preliminary report of this Commission was presented to Councils on October 14, 1882, and appeared in the *JOURNAL* of the Institute for April, 1883. It contained recommendations for the installation of machinery and apparatus in the several pumping stations, the completion and extension of reservoirs and the management of the stations. The final report was transmitted to Councils on April 5, 1883 (*J. F. I.*, Vol. 116, p. 321). Special attention was given to the future supply of the City and the reduction of waste. The use of meters for factories and large public buildings was suggested.

A paper on the Prevention of Fires in Theatres was read at the Stated Meeting held June 21 by Charles J. Hexamer, C. E., (*J. F. I.*, Vol. 114, pp. 125, 211). At the close of the discussion which followed the reading of the paper, it was voted to appoint a committee to investigate the subject of the prevention of fires in theatres. The report of this committee was presented to the Stated Meeting of the Institute on April 18, 1883, and printed in the *JOURNAL* for June (Vol. 115, p. 428). It contains much information on theatre fires, the hazards of artificial light, heating apparatus, fireworks, the use of paper wads in guns, the situation of the necessary work shops, paint lofts and spontaneous combustion. Considerable attention is given to the fire-proof drop curtain, and after having obtained information from many sources the committee expressed the opinion that woven asbestos cloth is most satisfactory. The report contains thirty-eight recommendations intended to make places of amusement more safe, nearly all of which have since been adopted.

1884, September 2 to October 11. The International Electrical Exhibition, held in the Pennsylvania Railroad Station at 32nd and Market Streets and a building especially erected at the northwest corner of 32nd Street and Lancaster Avenue.

Without Federal or State aid the Institute held the first great electrical exhibition in this country. Total number of paid admissions, 282,779; receipts from sale of tickets, \$98,639.70. 216 exhibitors.

By an act of congress the United States Electrical Commission was created for the purpose of conducting a national conference of electricians. This commission issued invitations to a large number of scientific gentlemen, both foreign and American, who assembled in conference on September 8 and continued their deliberations for six days.

During and immediately after the exhibition the most complete and extended series of tests attempted to that time were made to determine the characteristics of all the more important types of electrical apparatus and appliances then commercially used. The results of these tests were published in the *JOURNAL* and in pamphlet form during 1885 and 1886 as the Reports of the Examiners.

The organization of the American Institute of Electrical Engineers this year resulted from the holding of the electrical exhibition and the international conference of electricians.

1885, September 15 to October 31. The Novelties Exhibition held in the buildings erected for the use of the electrical exhibition; this was the twenty-ninth exhibition and was devoted to novelties in American Manufactures. 375 exhibitors.

Awards of medals and diplomas were made for articles of novel or intrinsic merit.

1886. At the Stated Meeting of the Institute held October 20, 1886, it was resolved, that the subject of organizing a State Weather Service be referred to a special committee, to be appointed by the President, with the request to report a plan for the same, if possible, to the Stated Meeting of the Institute in November.

On December 15 the special committee presented its report and recommended immediate organization of a "State Weather Service" with a volunteer force of observers; that the coöperation of railroad, telegraph and telephone companies and newspapers be solicited; that all institutions of learning throughout the state be invited to take an active interest in the collection of meteorological data and the study of the science; that an effort be made to secure an appropriation of \$3000 from the state, for the purchase of instruments and for the publication of the results of observations in tabulated form.

The offer of the Chief Signal Officer to furnish a member of the Signal Corps to assist in the work was accepted.

An Act to establish a State Weather Service was at once drafted and passed by the Legislature and the first Summary of Meteorological Reports giving the results of observations made in September appeared in October, 1887.

The service was in operation until May, 1891, when the State discontinued the appropriation.

1889. President Joseph M. Wilson, at the Stated Meeting of the Institute held November 20, made some remarks upon his observations of trade schools in France and England, having been charged with the task of investigating the organization and mode of operation of such institutions on behalf of the projected school of Mr. A. J. Drexel, of Philadelphia.

Mr. Wilson's complete report "On Schools: with particular reference to Trade Schools," appeared in the issues of the JOURNAL February to October inclusive, 1890.

1897. The Board of Health of the City of Philadelphia requested the appointment, by The Franklin Institute, of a committee to coöperate with the Board, in considering ways and means for the abatement of the growing evils arising from the increasing use of bituminous coal within the city limits.

At the meeting of the Institute of April 21, 1897, the regular order of business was suspended and the evening was devoted to the consideration of "The Smoke Nuisance and its Regulation." The discussion was introduced by a paper giving a brief historical account of the subject and some data having especial reference to the smoke question as it affects Philadelphia.

The discussion was continued by brief addresses from eleven prominent engineers and the president of the Board of Health.

The discussion was resumed at the meeting of May 19 by ten engineers of note and the president of the Board of Health.

It was the unanimous opinion of those present at the meeting of September 15, that the frequent discharge of dense black smoke from furnaces of stationary boilers is avoidable and should not be permitted in the city and that the emission of smoke from locomotives and furnaces might be greatly reduced if the coöperation of firemen and employers were enlisted with an earnest intention to abate the nuisance. Resolutions to this effect were approved and it was directed that copies be sent to the Mayor, the President of the Board of Health and to the president of Councils. At this meeting descriptions were presented of improved furnaces and automatic stokers. The representatives of five of the leading manufacturers were present and described their apparatus illustrating their remarks with the aid of models and lantern slides.

The discussion was concluded at the meeting of October 20 when ten stokers and furnaces were described.

A detailed account of the above discussion appeared in the issues of the JOURNAL for June, July and December, 1897, and January and February, 1898. 1899. National Export Exposition held in conjunction with the Commercial Museum of Philadelphia.

The seventy-fifth anniversary of the founding of the Institute was observed by a series of conferences and lectures held in the Convention Hall of the exposition on October 2 to 7 inclusive.

1901. A special Committee appointed by the President to consider the advisability and feasibility of the adoption of the metric system in the United States, presented its report on February 19, 1902.

The following preambles and resolutions submitted by the Committee were unanimously adopted:

WHEREAS, It is desirable to obtain an international standard of weights and measures, also to simplify and regulate some of our existing standards; and

WHEREAS, The metric system is commendable, not only as a suitable international standard, but also for facility of computation, convenience in memorizing and simplicity of enumeration;

Resolved, That The Franklin Institute approves of any movement which will promote the universal introduction of the metric system with the least confusion and expense.

Resolved, That the national Government should enact such laws as will ensure the adoption of the metric system of weights and measures as the sole standard in its various departments as rapidly as may be consistent with the public service.

The report, discussion and important correspondence on the subject were published in the JOURNAL for June, July and August, 1902.

In order to promote both domestic and foreign commerce, the following preambles and resolutions were adopted at the Stated Meeting of the Institute held on December 18:

WHEREAS, Greater and cheaper transportation facilities are essential to the development of our domestic and foreign commerce;

WHEREAS, The limited appropriations made by the National Government are inadequate to meet the requirements of the country, covering only a small percentage of the approved projects;

WHEREAS, The former policy of authorizing the improvement of our waterways by private capital resulted in a marked development without material cost or risk to the general Government;

WHEREAS, Early and economical results may be secured by a partial return to this method in localities where no provision has been made for immediate improvement; therefore, be it

Resolved, That the proper department of the general Government should be empowered to authorize the improvement, by individuals or corporations, of such rivers, harbors, canals or other waterways as are not provided for under the River and Harbor or the "Sundry Civil" Bills, with authority to collect tolls, upon plans and regulations to be approved by the said department; PROVIDED, that no part of the funds for such work shall be drawn from the public treasury of the United States. Also,

WHEREAS, The commercial and industrial interests of the country have attained such magnitude as to require a more systematic organization for their regulation and development;

WHEREAS, A measure known as Senate Bill No. 738 has been introduced into Congress for the purpose of establishing a Department of Commerce and Industries; therefore, be it

Resolved, That the establishment of such a Department of Commerce and Industries has the hearty approval of The Franklin Institute, and its early inauguration is recommended.

1906. At the Stated Meeting of the Institute, held September 19, at the conclusion of the reading of a paper on "The Relations of the Government to Our Waterways" by Prof. Lewis M. Haupt, the following preamble and resolutions were unanimously adopted:

WHEREAS, It is the present established policy of the General Government to provide ample facilities for the water-borne commerce of the United States and to emancipate inter-state commerce from the obstructions imposed by tolls or restricted canals under private or corporate control,

WHEREAS, This policy has been successfully inaugurated in all parts of the country with the exception of the early canals skirting the most populous and important cities of the Atlantic seaboard, and

WHEREAS, The best interests of the country demand the early construction of capacious canals connecting the interior waters of the bays and sounds of this coast, for commercial purposes as well as for national defense, and

WHEREAS, The most important and least expensive of these links is the one connecting the waters of the Chesapeake and Delaware Bays by a canal which is less than fourteen miles in length, and which has a trunk of only nine feet in depth and sixty-six feet minimum width, in which the Government is a joint owner, and concerning which its officials and commissions have

invariably reported that it is vital for the protection of the coast, as has been demonstrated in our several wars, and

WHEREAS, Congress has again authorized the appointment of a Commission to ascertain the expense of securing control of the works and franchises of the Chesapeake and Delaware Canal with a view to the acquisition of the aforesaid canal as a free and open waterway, which Commission is to report at the coming session of Congress.

Be it therefore *Resolved*, That The Franklin Institute of Pennsylvania reaffirms its position as to the urgent necessity of enlarging our coastwise waterways, and especially the Chesapeake and Delaware Canal for commercial and strategic purposes at the earliest practicable date.

Resolved, That a Committee be appointed to present this resolution to the Commission at the public hearing to be held in this city on the 27th instant.

1912. Centenary of the Introduction of Gas as an Illuminant observed on April 18 and 19.

The Institute with the coöperation of the American Philosophical Society, the American Chemical Society and the American Gas Institute arranged a series of meetings and lectures dealing with subjects relating to gas and gas manufacture. An important feature of the celebration was a loan exhibition of models, photographs, sketches, prints, manuscripts and drawings relating to every phase of the gas industry; also specimens of gas meters, lamps and burners, gas stoves and other appliances.

1914. Conducted meeting in Philadelphia on June 3 in commemoration of the thirtieth anniversary of the International Electrical Exhibition. Addresses were made by Messrs. E. W. Rice, Charles F. Brush and Frank J. Sprague.

1915. First awards of The Franklin Medal.

1916. Format of the JOURNAL changed from 6 x 9 inches to 6½ x 9½ inches with increase in the number of reading pages.

1917. Established and maintained a recruiting and examination station for applicants for admission to the Aviation Service of the United States Army. Established School of Navigation for the United States Shipping Board. Conducted free Radio School for men of the selective draft.

1920. Published "Physics of the Air," by W. J. Humphreys, C.E., Ph.D., 665 pages, illustrations, diagrams, octavo.

1921. Received \$1,208,468.32 from the bequest of Henry W. Bartol, a life-member of the Institute, for research. "Bartol Research Foundation," established for the purpose of conducting researches relating to fundamental problems in physical science, particularly those in the field of electricity, and for the investigation of specific problems of a scientific nature which may arise in the industries.

1922, March 6 to 10 inclusive. F. W. Aston, M.A., D.Sc., F.R.S., Fellow of Trinity College, Cambridge, England, delivered a course of lectures on "Atomic Weights and Isotopes."

1923, April 9 to 13 inclusive. Sir Joseph John Thomson, O.M., F.R.S., LL.D., Ph.D., D.Sc., Master of Trinity College, Cambridge, England, delivered a series of lectures on "The Electron in Chemistry." Subsequently published in book-form, 144 pages, octavo.

1923. Laboratory for conducting the work of the Bartol Research Foundation, provided for by the reconditioning of three buildings on the Institute's property, at Nineteenth and Cherry Streets.

1924, September 17, 18, 19. Centenary celebration of the founding of The Franklin Institute and the Inauguration Exercises of the Bartol Research Foundation.

SPEAKERS AT THE CENTENARY CELEBRATION

| | |
|--------------------------------|---------------------------------|
| PROFESSOR JOSEPH S. AMES | PROFESSOR A. A. MICHELSON |
| PROFESSOR WILDER D. BANCROFT | PROFESSOR DAYTON C. MILLER |
| PROFESSOR SIR WILLIAM H. BRAGG | PROFESSOR W. LASH MILLER |
| PROFESSOR WILLIAM L. BRAGG | DOCTOR RALPH MODJESKI |
| PROFESSOR P. W. BRIDGMAN | MR. DANIEL E. MORAN |
| GENERAL JOHN J. CARTY | SIR CHARLES ALGERNON PARSONS |
| PROFESSOR E. G. COKER | MAJOR GENERAL MASON M. PATRICK |
| DOCTOR WILLIAM D. COOLIDGE | DEAN HAROLD PENDER |
| DIRECTOR ARTHUR L. DAY | MR. F. W. PEEK |
| PROFESSOR F. G. DONNAN | DIRECTOR CHARLES L. REESE |
| DOCTOR WILLIAM LEROY EMMET | DOCTOR E. W. RICE |
| PROFESSOR CHARLES FABRY | PROFESSOR SIR ERNEST RUTHERFORD |
| PROFESSOR F. HABER | PROVOST EMERITUS EDGAR F. SMITH |
| PROFESSOR W. J. HUMPHREYS | DOCTOR FRANK J. SPRAGUE |
| PROFESSOR D. S. JACOBUS | MAJOR GENERAL GEORGE O. SQUIER |
| BRIGADIER GENERAL EDGAR JADWIN | PROFESSOR JULIUS STIEGLITZ |
| DOCTOR GEORGE L. KELLEY | PROFESSOR BRADLEY STOUGHTON |
| PROFESSOR A. E. KENNELLY | PROFESSOR W. F. G. SWANN |
| DEAN DEXTER S. KIMBALL | PROFESSOR JOHN SEALY EDWARD |
| DOCTOR IRVING LANGMUIR | TOWNSEND |
| DOCTOR ARTHUR D. LITTLE | PROFESSOR AUGUSTUS TROWBRIDGE |
| PROFESSOR C. H. MATHEWSON | MAJOR GENERAL C. C. WILLIAMS |
| DOCTOR C. E. K. MEES | PROFESSOR PIETER ZEEMAN |
| PROFESSOR CHARLES MENDENHALL | |

**CENTENARY CELEBRATION OF THE FOUNDING OF
THE FRANKLIN INSTITUTE
AND THE INAUGURATION EXERCISES OF THE BARTOL
RESEARCH FOUNDATION**

September 17, 18, 19, 1924, Philadelphia

THE COMMITTEES OF THE CENTENARY CELEBRATION

HONORARY COMMITTEE

ELIHU THOMSON, *Chairman*

NICHOLAS F. BRADY
WALTON CLARK
MORRIS L. CLOTHIER
CHARLES A. COFFIN
PIERRE S. DU PONT
THOMAS A. EDISON
SAMUEL INSULL
JOSEPH B. MCCALL
RANDAL MORGAN
WILLIAM H. NICHOLS

JOSIAH H. PENNIMAN
JOHN J. PERSHING
J. HOWARD PEW
SAMUEL REA
THEODORE W. RICHARDS
WILLIAM CAMERON SPROUL
HARRY B. THAYER
SAMUEL M. VAUCLAIN
RODMAN WANAMAKER
EDWARD WESTON

EXECUTIVE COMMITTEE

WM. C. L. EGLIN

WALTON CLARK

C. C. TUTWILER

HENRY HOWSON, *Treasurer*

GELLERT ALLEMAN, *Chairman*

PROGRAM

WEDNESDAY, SEPTEMBER 17TH

- 9.00 A.M. Assembly of Delegates and Guests at the Hall of The Franklin Institute, 15 South Seventh Street.
- 9.45 A.M. Academic Procession from the Hall of The Franklin Institute to the Walnut Street Theatre. Academic Costume is in order, but not required.
- 10.15 A.M. Invocation, Reverend Louis C. Washburn, S.T.D., Rector of Christ Church, Philadelphia.
- 10.30 A.M. Address of Welcome. The Honorable W. Freeland Kendrick, Mayor of Philadelphia. Address: President Wm. C. L. Eglin, Sc.D. Address: Professor Elihu Thomson, Ph.D., Sc.D., Honorary Chairman of the Centenary Celebration Committee of The Franklin Institute.
- 1.00 P.M. Luncheon to Delegates and Guests, the Bellevue-Stratford.
- 2.30 P.M. Sectional Meetings, The Franklin Institute, 15 South Seventh Street, the University of Pennsylvania.
- 7.30 P.M. Dinner Parties.

THURSDAY, SEPTEMBER 18TH

- 10.00 A.M. Sectional Meetings, the University of Pennsylvania.
 1.30 P.M. Luncheon to Delegates and Guests, the Bellevue-Stratford.
 2.30 P.M. to 6.00 P.M. Garden Party.
 8.30 P.M. Open Meeting, the University Museum, Thirty-third and Spruce Streets. President Wm. C. L. Eglin, Sc.D., presiding, will introduce the Chairman of the evening, The Hon. William Cameron Sproul, LL.D. Address: "The Natural and Artificial Disintegration of Elements," by Professor Sir Ernest Rutherford, Kt., D.Sc., LL.D., Ph.D., D.Phys., F.R.S., Trinity College, Cambridge.

FRIDAY, SEPTEMBER 19TH

- 9.30 A.M. Unveiling of Tablet at Bartol Research Foundation, 127 North Nineteenth Street, Mr. C. C. Tutwiler, presiding.
 9.45 A.M. The Academy of Natural Sciences, Nineteenth and Race Streets. Address: "The Fifth Estate," by Arthur D. Little, Chem.D., Cambridge. Address: "Stimulation of Research and Invention," by Professor D. S. Jacobus, Dr. Eng., New York City.
 11.30 A.M. Sectional Meetings, the University of Pennsylvania.
 2.00 P.M. Luncheon to Delegates and Guests, the Bellevue-Stratford.
 4.00 P.M. Convocation at the University of Pennsylvania, President Josiah Harmer Penniman, Ph.D., LL.D., L.H.D., presiding.
 7.30 P.M. Banquet to Delegates and Guests, the Bellevue-Stratford.
 Presentation of greetings from universities, colleges, learned and professional societies and industrial organizations.

SECTIONAL MEETINGS

WEDNESDAY, SEPTEMBER 17TH

- 2.30 P.M. The Hall of The Franklin Institute, 15 South Seventh Street. Rear Admiral W. A. Moffett, presiding.
 Professor Joseph S. Ames, Ph.D., LL.D., The Johns Hopkins University, "Recent Developments in Aeronautics."
 Major General Mason M. Patrick, Chief, United States Air Service, "Military Aircraft and Their Use in Warfare."
 Major General George Owen Squier, Ph.D., United States War Department, "Electrical Communication for Military Purposes."
 General John J. Carty, D.Sc., LL.D., American Telephone and Telegraph Company, "Progress in Telephony."
 2.30 P.M. Lecture Room No. 216, Engineering Building, University of Pennsylvania. Dean Howard McClenahan, presiding.
 Professor W. Lash Miller, Ph.D., University of Toronto, "Concentration and Polarization at the Cathode during Electrolysis of Solutions of Copper Salts."
 Professor Julius Stieglitz, Ph.D., D.Sc., Ch.D., University of Chicago, "The Theory of Color Production in Organic and Inorganic Compounds."
 Professor E. G. Coker, M.A., D.Sc., F.R.S., University College, London, "Photo-elasticity."

2.30 P.M. Lecture Room No. 226, Engineering Building, University of Pennsylvania. Doctor Frank J. Sprague, presiding.

Dean Dexter S. Kimball, M.E., The College of Engineering, Cornell University, "The Progress and Promise of Engineering."

Daniel E. Moran, M.Sc., Consulting Engineer, "Some of the Effects of Loading Granular Material."

Brigadier General Edgar Jadwin, United States War Department, "Modern Military Engineering."

2.30 P.M. Lecture Room No. 314, Engineering Building, University of Pennsylvania. Director Arthur L. Day, presiding.

Professor W. J. Humphreys, C.E., Ph.D., United States Weather Bureau, "The Way of the Wind."

William D. Coolidge, Ph.D., General Electric Company, "Modern X-ray Tube Development."

Professor William Lawrence Bragg, M.A., F.R.S., Victoria University, "Inorganic Crystals."

THURSDAY, SEPTEMBER 18TH

10.00 A.M. Harrison Chemical Laboratory, University of Pennsylvania. Doctor Willis R., Whitney, presiding.

Professor F. Haber, Ph.D., Direktor, Institut für Physikalische Chemie und Elektrochemie, "Technical Results of the Theoretical Development in Chemistry."

Director Arthur L. Day, Ph.D., Sc.D., Geophysical Laboratory, Carnegie Institution, "Some Causes of Volcanic Activity."

Professor Wilder D. Bancroft, Ph.D., Cornell University, "The Development of Colloid Chemistry."

Director C. E. K. Mees, D.Sc., Eastman Kodak Company, "Applied and Scientific Photography."

10.00 A.M. Lecture Room No. 214, Engineering Building, University of Pennsylvania. General Guy E. Tripp, presiding.

Professor P. W. Bridgman, Ph.D., Harvard University, "Some Aspects of High Pressure Research."

Professor Dayton C. Miller, Sc.D., Case School of Applied Science, "The Phonodeik."

Professor Charles E. Mendenhall, Ph.D., The University of Wisconsin, "Electronic Phenomena at the Surface of Metals."

Professor Sir William Henry Bragg, K.B.E., M.A., D.Sc., F.R.S., Royal Institution, "The Carbon Atom in Crystalline Structure."

10.00 A.M. Lecture Room No. 216, Engineering Building, University of Pennsylvania. Professor Augustus Trowbridge, presiding.

Irving Langmuir, Ph.D., D.Sc., LL.D., General Electric Company, "Electric Discharges in Gases at Low Pressures."

Professor Charles Fabry, University of Paris, "Spectroscopy in Past and Present."

Professor Augustus Trowbridge, Ph.D., Princeton University, "Infra-red Spectroscopy."

F. W. Peek, General Electric Company, "Lightning."

Professor A. E. Kennelly, Sc.D., Harvard University and Massachusetts Institute of Technology, "The Measurement of Acoustic Impedance by the Aid of the Telephone Receiver."

10.00 A.M. University of Pennsylvania Museum. Doctor Samuel Insull, presiding.

E. W. Rice, Jr., Sc.D., D.Eng., Honorary Chairman, General Electric Company, "The Field of Research in Industrial Institutions."

Ralph Modjeski, Dr. Engr., Consulting Engineer, "Unusual Problems Encountered in the Design and Construction of Large Bridges."

Sir Charles Algernon Parsons, K.C.B., M.A., LL.D., D.Sc., F.R.S., Newcastle-on-Tyne, "Steam Turbines on Land and Sea."

William LeRoy Emmet, Sc.D., General Electric Company, "Mercury Boiler."

FRIDAY, SEPTEMBER 19TH

11.30 A.M. Harrison Chemical Laboratory, University of Pennsylvania. Professor Joseph S. Ames, presiding.

Professor Pieter Zeeman, Ph.D., Sc.D., University of Amsterdam, "Radiating Atoms in Magnetic Fields."

Professor John Sealy Edward Townsend, F.R.S., University of Oxford, "Motion of Electrons in Gases."

Professor W. F. G. Swann, D.Sc., University of Chicago, "The Origin of the Earth's Electric and Magnetic Phenomena."

J. Slepian, M.A., Ph.D., The Westinghouse Electric and Manufacturing Company, "Electric Discharges Between High Resistance Electrodes."

11.30 A.M. Lecture Room No. 216, Engineering Building, University of Pennsylvania. Doctor Arthur D. Little, presiding.

Director Charles L. Reese, Ph.D., Sc.D., E. I. du Pont de Nemours and Company, "Twenty-five Years' Progress in Explosives."

Professor F. G. Donnan, C.B.E., M.A., Ph.D., D.Sc., F.I.C., F.R.S., University College, London, "The Influence of J. Willard Gibbs on the Science of Physical Chemistry."

Provost Emeritus Edgar F. Smith, Ph.D., LL.D., L.H.D., Chem.D., Litt.D., M.D., University of Pennsylvania, "Early Science in Philadelphia."

11.30 A.M. Lecture Room No. 226, Engineering Building, University of Pennsylvania. Professor A. E. Outerbridge, Jr., presiding.

Professor C. H. Mathewson, Ph.D., Yale University, "The Trend in Physical Metallurgy."

George L. Kelley, Ph.D., Philadelphia, "The Restraint of Exaggerated Grain Growth in Critically Strained Metals."

Professor Bradley Stoughton, Lehigh University, "Magnetic Analysis of Steel."

T. D. Yensen, E.E., The Westinghouse Electric and Manufacturing Company, "Magnetic Properties of Fifty Per Cent. Iron, Fifty Per Cent. Nickel Alloys."

11.30 A.M. Lecture Room No. 314, Engineering Building, University of Pennsylvania. Major General George O. Squier, presiding.

Dean Harold Pender, Ph.D., Moore School of Electrical Engineering, University of Pennsylvania, "A New Type of Non-inductive High Resistance."

Professor A. A. Michelson, Ph.D., Sc.D., LL.D., The University of Chicago, "Velocity of Light."

Major General C. C. Williams, United States War Department, "Modern Ordnance."

officers shall be elected at an annual meeting of the said corporation, to be held on the third Thursday of January; if an election shall not take place on that day, the corporation shall not for that cause be dissolved, but an election shall be held as soon afterwards as may be, and until such election the officers in place shall continue to act; public notice of all elections shall be given in such manner as may be prescribed by the by-laws of the said corporation; the present officers of the said association are hereby constituted the officers of the corporation hereby created and shall continue to hold their respective offices till otherwise elected under the provisions of this act; Provided always, that the said corporation shall have power to increase the number of vice-presidents and managers hereinbefore mentioned, to such number as may be deemed advisable and convenient at a stated meeting of the said corporation, the same public notice of such intended alteration being previously given as may be required to be given of the election of officers of the said corporation.

SEC. 5. And be it further enacted by the authority aforesaid, That the duties and rights of the members of the said corporation, the powers and functions of the members of the said corporation, the powers and functions of the officers thereof hereinbefore mentioned, and of such others as may hereafter be added, the mode of supplying vacancies in office, the times of meeting of the said corporation, and of the board of managers, the numbers which shall constitute a quorum at any such meetings, the mode of electing members, the terms of their admission, the causes which shall justify their suspension or expulsion from the corporation, and all other concerns of the said corporation shall be regulated by the by-laws and ordinances of the said corporation hereafter to be made, which the said corporation is hereby authorized and empowered to make and alter, in the manner which may be therein mentioned; Provided that the said by-laws or ordinances shall not be repugnant to, or inconsistent with, the constitution or laws of the United States or of this Commonwealth.

OFFICE OF THE CLERK OF THE SENATE OF THE COMMONWEALTH OF
PENNSYLVANIA,

March 30th, 1824.

I certify that the foregoing Bill passed both branches of the Legislature, and received the signature of the Governor on this day. As witness my hand the day and year above written.

(Signed.)

JNO. DUPUY, *Clerk.*

An Act to amend and alter the Act incorporating The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts.

WHEREAS, The Act approved March thirtieth, one thousand eight hundred and twenty-four, incorporating The Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, has been found insufficient and inconvenient for accomplishing the objects of said corporation, and the said corporation has applied for alteration and amendment thereof.

SECTION 1. Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania, in General Assembly met, and it is

hereby enacted by the authority of the same, that the present members of said corporation, and all such persons as may hereafter become members thereof, shall be, and are hereby created, a body politic and corporate by the name of "THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS," and shall have perpetual succession, be able to sue and be sued, to plead and be impleaded, to have and use a common seal, and the same to break, alter and renew at pleasure, and shall be able to take, hold, purchase and enjoy such real and other estates of any nature or kind whatsoever as they may obtain by purchase, devise, bequest or gift, and the same at their pleasure to sell, lease, mortgage, pledge, encumber, or dispose of as they may deem proper or convenient for promoting the objects of the said corporation; and the said corporation shall have the like power over any real estate or other estates now owned or held by them; *provided*, that the clear yearly value of the real estate at any time held by them shall not exceed ten thousand dollars.

SEC. 2. That it shall be lawful for the said corporation to raise funds for the payment of its present indebtedness, and for all other purposes of the said corporation, to create and sell such number of shares of stock, at ten dollars each, as may be deemed proper to represent the estates of the said corporation, and the certificates of such stock shall be in such form, be transferable in such manner, subject to such payments, and entitle the holder thereof to such privileges, as the said corporation may, by its By-Laws in reference to such stock, grant and direct.

SEC. 3. The object of the said corporation shall be the promotion and encouragement of manufactures and the mechanical and useful arts, by the establishment of lectures on the sciences connected with them, by the formation of cabinets of models, minerals, machines, materials and products by exhibitions and premiums, by a library and by all such measures as they may judge expedient.

SEC. 4. The members of the said corporation shall consist of manufacturers, mechanics, artisans, and persons friendly to the mechanic arts, and of such stockholders in said corporation as may, by the By-Laws, be entitled to the privileges of members; and every member shall pay such sum for an annual or life subscription as the By-Laws of said corporation may require; and honorary and corresponding members may be elected at such times, and in such a way, and with such privileges as said corporation may deem expedient.

SEC. 5. The said corporation shall be managed in such way, and by such number of officers, managers and other persons as the By-Laws may prescribe, and the powers and functions of such officers, managers or other persons, the rights and duties of members, the manner of their election, and the causes which may justify their expulsion or suspension, and all other concerns of the said corporation, shall be fixed and regulated by its By-Laws, which By-Laws shall be adopted by said corporation at the first monthly meeting after the acceptance of this amended Charter, and said By-Laws shall be altered and amended only in the manner provided in said By-Laws as then adopted.

SEC. 6. So much of the Act to which this is a supplement as is inconsistent herewith is repealed.

OFFICE OF THE SECRETARY OF THE COMMONWEALTH OF PENNSYLVANIA,

April 25th, 1864.

I certify that the foregoing bill passed both branches of the Legislature, and received the signature of the Governor on this day. As witness my hand the day and the year above written.

(Signed.)

ELI SLIFER, *Secretary of the Commonwealth.*

BY-LAWS OF THE INSTITUTE

ARTICLE I.—*Stock*

SECTION 1. The Real and Personal Estates of the Institute as held upon the First day of January, One Thousand Eight Hundred and Eighty-one, shall be valued at One Hundred Thousand Dollars, and shall be represented by Ten Thousand Shares of Stock of the par value of Ten Dollars each. Said shares shall be divided into two classes, *viz.*:—

First Class.—Shares not registered for use: on which no annual payment shall be charged or collected, and the holders thereof shall not have the privileges of members of the Institute, but may, if of legal age, vote at any annual election for officers and managers upon the payment of One Dollar upon each share of stock on which they may desire to vote; provided, however, such shares have been held by the same person at least three months before such election.

Shares of the First Class may be converted into shares of the Second Class at the pleasure of the owners, provided the transfer be approved by the Board of Managers; but, when once so converted, they shall always continue in the Second Class.

Second Class.—Shares registered for use: on which Twelve Dollars per annum shall be due and payable from resident members in advance on the first day of October in each year, except as hereinafter provided.

Non-resident holders of Second Class stock shall pay an annual fee of Five Dollars.

SEC. 2. The holders of Second Class stock shall be entitled to the use of the library, lectures and reading-room; and, if of legal age, to all other privileges of membership in the Institute, so long as they make the annual payment in advance; and shall, on the payment of One Dollar therefore, be entitled to a Certificate of Membership.

SEC. 3. If the annual dues for successive years remain unpaid at the expiration of two and a half years on any share of stock of the Second Class, such share shall then become forfeited to the Institute; but such forfeiture may be remitted by a unanimous vote of the Board of Managers.

SEC. 4. Stock of the Second Class may be held in trust for persons not of legal age, and shall be liable to the payment of only one-half the annual fees due upon stock of Second Class held by persons of legal age; provided, that when such minors arrive at legal age, new certificates, subject to the full annual contribution, shall issue on payment of the customary fee.

SEC. 5. Certificates for the First Class stock may be issued for any number of shares in a single certificate; but every certificate for the Second Class shall be for one share only.

SEC. 6. No share of stock in the Second Class shall be transferred until all arrearages and fines are paid, and all books and tickets returned, and the transfer approved by the Board of Managers.

SEC. 7. All certificates of stock shall be signed by the President and Secretary; shall be issued by the Controller, and shall be transferable only on the books of the Institute by the owner, or his legal representative, on the surrender of the old certificate, and of a fee of twenty-five cents for each certificate.

SEC. 8. All subscriptions to stock shall be approved by the Board of Managers before the certificate can be issued.

ARTICLE II.—*Members*

SECTION 1. Members of the Institute shall consist of those engaged or interested in scientific pursuits or in the application of science in the mechanic and industrial arts. Members shall be classed as follows: Honorary and Corresponding, Endowment, Life, Contributing, Resident, Non-resident, holders of Second Class stock.

SEC. 2. Honorary and Corresponding members shall be nominated by the Board of Managers and shall require for their election four-fifths of the votes of the members present at any stated meeting of the Institute at which their nomination may be acted upon. They shall not be entitled to vote or hold office. All other members shall be elected by the Board of Managers.

SEC. 3. Endowment members shall consist of persons, firms, corporations or associations who shall make an endowment payment of Five Thousand Dollars (\$5000) to the Institute, and who, upon acceptance thereof by the Board of Managers, shall thereafter have the privilege of nominating annually to the Board of Managers for election (subject to its discretion as to any particular nominee) as Resident members of the Institute for its then current year without payment of dues that number of persons, to be determined from time to time by the Board of Managers, whose annual dues if they were paying annual Resident Membership dues would approximately equal but not exceed the then current income from such endowment payments. Such Endowment Memberships shall be perpetual, and shall be transferable by the holders thereof by will or otherwise: Provided, however, that the Board of Managers at any time may refund Five Thousand Dollars (\$5000) to the then holders of any such membership, and annul and terminate that membership.

SEC. 4. Resident Life members, whose memberships shall not be transferable, shall pay the sum of Three Hundred Dollars (\$300) in any one year. Non-resident Life members shall be those who reside permanently at a distance of not less than twenty-five miles from Philadelphia and shall pay the sum of One Hundred Dollars (\$100) in any one year.

SEC. 5. Contributing members shall consist of firms, corporations, associations or individuals who shall pay annually the sum of Three Hundred Dollars (\$300). A Contributing member shall have the privilege of nominating nineteen persons to the Board of Managers for election as Resident members for the year then current, subject to the discretion of the Board as to any particular nominee, and members thus elected shall pay no dues.

SEC. 6. Resident members shall pay annual dues of Fifteen Dollars (\$15).

SEC. 7. Non-resident members shall be those who reside permanently at a distance of not less than twenty-five miles from Philadelphia. They shall pay an entrance fee of Five Dollars and annual dues of Five Dollars. Transfers of membership from the Resident to Non-resident class may be granted by the Board of Managers at its discretion in cases of temporary absence of members from the City for a period of not less than one year.

ARTICLE III.—*Payments of Dues*

SECTION 1. The annual fees for membership shall be due and payable on the first of October in each year, in advance, but all members elected after the thirty-first of March in each year shall pay in advance for the current year one-half of the annual dues.

SEC. 2. Any member whose dues are more than three months in arrears shall be notified by the Controller. Should such dues not be paid when they become six months in arrears, the privileges of membership shall be suspended. When nine months in arrears such member shall be notified again, and if such dues become one year in arrears, the said member shall forfeit all connection with the Institute. The Board of Managers at its discretion may extend the time for payment and for the application of these penalties.

The Board of Managers may remit temporarily the annual dues of any member who, for reasons satisfactory to the Board, is unable to pay such dues; and the Board may remit the whole or part of the dues in arrears or accept in lieu thereof service or material contributed to the Institute.

SEC. 3. Every person admitted to membership in the Institute shall be considered as liable for the payment of dues until he shall have resigned, been dropped or have been relieved therefrom by the Board of Managers.

SEC. 4. Resignations of membership shall be made to the Board of Managers in writing, but need not be accepted until all dues and arrears up to date of resignation shall have been paid.

SEC. 5. The annual dues from members may be applied to the current expenses of the Institute, but all moneys received from Life and Endowment memberships shall be added to the capital account of the Institute, and only the income therefrom shall be applied to current expenses.

ARTICLE IV.—*Election of Officers*

SECTION 1. The officers shall be a President, three Vice-presidents, a Secretary, a Treasurer, a Controller, a Librarian, and twenty-four Managers.

SEC. 2. At the annual meeting of the Institute the President and the Treasurer shall be elected to serve one year, and one Vice-president, and eight Managers, shall be elected to serve for three years; provided, that the officers now elected or who may hereafter be elected shall continue to serve until their successors be elected.

SEC. 3. All elections for officers of the Institute shall be by letter ballot, and no vote may be cast by proxy.

SEC. 4. Nominations for President, Vice-president, Treasurer and Managers shall be made in writing at the stated meeting in the month of

December. Each nomination paper must be signed by at least two members, who shall certify that the candidate will serve if elected. After the nominations are closed, the President shall appoint three members, who are neither officers nor nominees, to act as tellers of the election. The list of nominees shall be posted at the Institute and incorporated (with directions for voting) in a ballot to be sent to each member by the Secretary at least one week before the date of the election. Each ballot shall be accompanied by a return envelope addressed "To the Tellers of Election," and provided with a space for the signature of the member voting.

SEC. 5. On the date of the annual meeting, and at an hour previously designated by their chairman, the tellers shall meet at the Institute and shall count all legal votes that have been received by mail or placed in the ballot box before 8 o'clock P.M.; and when the count is completed they shall report to the annual meeting of the Institute the total number of ballots cast, together with the number of votes received by each candidate. Thereupon the presiding officer shall announce the names of the candidates who received the plurality of votes for each office, and shall declare them elected officers of the Institute for the ensuing terms.

ARTICLE V.—*Duties of Officers*

SECTION 1. The President shall be the executive head of the Institute and as such shall have the general direction and supervision of all the affairs of the Institute. He shall preside at all meetings of the Institute and of the Board of Managers and shall be ex officio a member of all committees of the Institute and of the Board.

SEC. 2. The Vice-presidents shall exercise the duties of the President in his absence in the order of their seniority in office.

SEC. 3. The Secretary of the Institute shall be appointed by the Board of Managers and shall have charge and supervision, subject to the Board of Managers, of all the scientific activities of the Institute, other than those connected with the Bartol Research Foundation, its publications, museum and equipment. He shall keep the minutes of all meetings of the Institute and of the Board of Managers, and shall perform all the duties usually pertaining to the office of Secretary. He shall be ex officio a member of the Board of Managers, and of all standing committees of the Institute and of the Committee on Publications of the Board of Managers.

SEC. 4. The Treasurer shall receive all funds, payable to the Board of Managers, and all moneys collected for the Institute. He shall deposit all moneys received, in the name of the Institute, in such banks or trust companies as the Board of Managers may direct. He shall make no payments without the authority of the Board of Managers. He shall see that there are kept accurate accounts of the income and disbursements of the Institute, shall report current receipts and payments at each stated meeting of the Board of Managers, and shall make a detailed statement of the financial condition of the Institute as its annual meeting. He shall give bond to an amount, and with such surety, as the Board of Managers shall determine. In case of a vacancy in the office of Treasurer, it shall be the duty of the Board of Managers to appoint a person to perform the duties of the position until the next annual meeting.

SEC. 5. The Board of Managers shall appoint the Controller, who shall keep all the accounts of the Institute, shall collect all moneys due the Institute and deposit them in the Treasurer's account, and shall approve all expenditures. He shall act with the Committee on Finance in the preparation of the annual budget. He shall act as the business agent of the publications of the Institute. He shall have charge of the buildings of the Institute and shall be responsible for their maintenance, repairs and insurance. He shall perform such other duties as may be prescribed by the Board of Managers.

SEC. 6. The Board of Managers shall appoint a Librarian, who shall have charge of the library and reading-room of the Institute, and who shall perform the duties usually pertaining to such office, subject to instructions from the Board.

ARTICLE VI.—*Board of Managers*

SECTION 1. The Board of Managers shall have entire charge and control of the affairs of the Institute, and shall consist of twenty-four members elected as provided in Article IV. The President, the Vice-presidents, the Secretary, the Treasurer, and the Chairman of the Committee on Science and the Arts shall be *ex officio* members.

SEC. 2. They shall present, through the President, at the annual meeting of the Institute, a report of their proceedings and of the condition of the affairs of the Institute.

SEC. 3. They shall hold stated meetings once in each month except in July and August. The chairman shall be the President of the Institute. Seven of their members shall constitute a quorum.

SEC. 4. Special meetings may be called by the President at his discretion, and shall be called by him on written request of the Executive Committee or of any seven members of the Board. In case of his absence or refusal to act, such special meeting shall be called by the Secretary.

SEC. 5. Members who have not attended five regular meetings in the twelve months prior to the stated meeting of the Institute in December, shall be reported thereat as having resigned, unless it be unanimously voted by the Board at that meeting, that such member has been absent for sufficient reason.

SEC. 6. All vacancies on the Board of Managers shall be filled by the Board until the next annual meeting of the Institute.

ARTICLE VII.—*Committees of the Board of Managers*

The following standing committees of the Board of Managers, each consisting of five members, shall be appointed by the President and approved by the Board:

1. Executive.
2. On Endowment.
3. On Finance.
4. On Membership.
5. On Publications.
6. On Bartol Research Foundation.

The Executive Committee shall make to the Board such recommendation as it may deem advisable, but in the absence of specific delegation of authority, it shall have no power to act on behalf of the Board.

The Committee on Finance shall have charge of all securities and investment funds belonging to the Institute and shall invest and reinvest the same and pay the income therefrom to the Treasurer of the Institute. The Committee may, with the approval of the Board of Managers, appoint a trust company of the

City of Philadelphia to act as fiscal agent under the direction of the Committee. All purchases or sales of securities shall be reported monthly to the Board.

The Bartol Research Foundation Committee shall have charge of the provision, maintenance and operation of all laboratories and equipment concerning the Bartol Research Foundation. It shall engage the professional staff subject to the approval of the Board of Managers of the Institute and shall also engage and direct the operators and helpers employed in the work of the Foundation. It shall be composed of not more than twelve members, as follows: Five members of the Board of Managers, appointed by the President and approved by the Board; the President; the Director of the Bartol Research Laboratories; five members appointed by the President with the approval of the Board from the membership of the Institute not members of the Board.

The Director of the Bartol Research Laboratories shall report to the Bartol Research Foundation Committee. All other employees of the Foundation shall report to the Director. The Committee shall have full power to carry out the purposes of the Foundation. It shall make a report of its operation to the Board of Managers at each stated meeting.

ARTICLE VIII.—*Audits*

The accounts of the Treasurer and of the Fiscal Agent shall be audited at least once a year by certified public accountants, who shall report to the Board of Managers.

ARTICLE IX.—*Committees of the Institute*

SECTION 1. There shall be the following standing committees of the Institute:

1. On Library.
2. On Meetings.
3. On Museum.
4. On Science and the Arts.

SEC. 2. The Committees on Library, Meetings and Museum shall consist of ten members each, appointed by the President at the first stated meeting after the annual election, to serve one year.

SEC. 3. The Committee on Library shall purchase books and other publications of a kind and character suitable to and consonant with the purpose of the Institute's library.

SEC. 4. The Committee on Meetings shall act with the Secretary of the Institute to secure for presentation before the Institute papers dealing authoritatively with subjects of import in the fields of physical science and engineering.

SEC. 5. The Committee on Science and the Arts shall consist of sixty members who shall serve three years. Twenty shall be elected each year by the Board of Managers at the first meeting after the annual election. The Committee shall investigate current discoveries, inventions and other achievements of workers in the physical sciences and their application in the mechanic and industrial arts with a view of affording such recognitions as lie within the power of the Institute to bestow.

SEC. 6. These committees shall organize and adopt rules and regulations suitable to their several activities, subject to the approval of the Board.

ARTICLE X.—*Meetings*

SECTION 1. The Institute shall hold stated meetings on the third Wednesday of each month, except in June, July, August, and September. That on the third Wednesday in January of each year shall be the annual meeting.

SEC. 2. Special meetings shall be called by order of the President, upon request of the Board of Managers, or the written application of twelve members of the Institute. Fifteen members shall constitute a quorum.

ARTICLE XI.—*Amendments*

These By-Laws may be altered or amended at any stated meeting of the members of the Institute, provided notice in writing, signed by two members, of the proposed alteration or amendment, shall be given to the Board of Managers two months prior to the said meeting, except that amendments to Article I, relating to capital stock, must be ratified subsequently by a majority of the stock represented at a meeting specially called for this purpose.

BY-LAWS OF THE BOARD OF MANAGERS*Organization Meeting.*

A meeting for the purpose of organizing, electing members of the Committee on Science and the Arts, appointing a Secretary, an Assistant Secretary and Librarian, a Controller and Standing Committees, shall be held on the fourth Wednesday in January, at 4.15 o'clock, P.M.

Stated Meetings.

Stated meetings shall be held on the second Wednesday of each month at 4.15 o'clock, P.M.

Order of Business.

1. Calling the roll.
2. Reading the minutes of the previous meeting.
3. Report from Treasurer.
4. Reports from Standing Committees of the Board of Managers:
5. Reports from Standing Committees of the Institute:
 - (a) Finance.
 - (b) Membership.
 - (c) Publications.
 - (d) Bartol Research Foundation.
 - (e) Endowment.
 - (f) Executive.
6. Reports from Special Committees.
 - (a) Library.
 - (b) Meetings.
 - (c) Museum.
 - (d) Science and the Arts.
7. Deferred Business.
8. New Business.

Reports.

All committees of the Board shall keep regular minutes of their proceedings and shall report monthly to the Board; they shall also report, through the Committee on Finance, to the stated meeting of the Board in September, an estimate of monies they require for the service of the ensuing year.

AWARDS BY THE INSTITUTE

The following awards are made by The Franklin Institute:

The Franklin Medal.
The Elliott Cresson Medal.
The Howard N. Potts Medal.
The Louis Edward Levy Medal.
The George R. Henderson Medal.
The Edward Longstreth Medal.
The Certificate of Merit.
The Boyden Premium.

The making or recommending of these awards is, by resolution of the Institute, entrusted to its Committee on Science and the Arts, a Committee consisting of sixty members of the Institute. This Committee recommends to the Institute the award of the Franklin Medal to distinguished scientists or technologists; and investigates, upon application, and reports on any worthy invention, discovery or process, recommending the award, according to merit, of the Elliott Cresson Medal, the Howard N. Potts Medal, the Edward Longstreth Medal, or the Certificate of Merit.

The Franklin Medal (Gold Medal and Certificate).—This medal is awarded annually from the Franklin Medal Fund, founded January 1, 1914, by Samuel Insull, Esq., to those workers in physical science or technology, without regard to country, whose efforts, in the opinion of the Institute, acting through its Committee on Science and the Arts, have done most to advance a knowledge of physical science or its applications.

The Elliott Cresson Medal (Gold Medal and Certificate).—This medal is awarded for discovery or original research, adding to the sum of human knowledge, irrespective of commercial value; leading and practical utilizations of discovery; and invention, methods of products embodying substantial elements of leadership in their respective classes, or unusual skill or perfection in workmanship.

The Howard N. Potts Medal (Gold Medal and Certificate).—This medal is awarded for distinguished work in science or the arts; important development of previous basic discoveries; inventions or products of superior excellence or utilizing important principles; and for papers of especial merit that have been presented to the Institute and published in its JOURNAL.

The Louis E. Levy Medal (Gold Medal and Certificate).—This medal is awarded to the author of a paper of especial merit, published in the JOURNAL OF THE FRANKLIN INSTITUTE, preference being given to one describing the author's experimental and theoretical researches in a subject of fundamental importance.

The George R. Henderson Medal (Gold Medal and Certificate).—This medal is awarded for meritorious inventions or discoveries in the field of railway engineering.

The Edward Longstreth Medal (Silver Medal and Certificate).—This medal, with a money premium when the accumulated interest of the fund permits, is awarded for meritorious work in science or the arts. In the event of an accumulation of the fund for medals beyond the sum of one hundred dollars, it is competent for the Committee on Science and the Arts to offer from such surplus a money premium for some special work on any mechanical or scientific subject that is considered of sufficient importance.

The Certificate of Merit.—A Certificate of Merit is awarded to persons adjudged worthy thereof for their inventions, discoveries or productions.

The Boyden Premium (Premium of \$1000).—To any resident of North America who shall determine by experiment whether all rays of light and other physical rays are or are not transmitted with the same velocity.

HISTORY OF THE MEDALS

The Franklin Medal.—Samuel Insull, Esq., of Chicago, Illinois, writing under date of December 23, 1913, to the Board of Managers, stated that he had been informed it would be a source of gratification to them if the Institute had available, in addition to such medals already in its gifts, a medal to be known as The Franklin Medal, and to be awarded from time to time in recognition of the total contributions of individuals to science or to the applications of physical science to industry, rather than in recognition of any single invention or discovery, however important. He agreed to provide for the founding of this medal under the following general conditions:

1. That an amount not exceeding one thousand dollars should be furnished by him for procuring appropriate designs and dies for the medal and diploma.
2. That the medal should possess distinct artistic merit, and have on one side a medallion of Benjamin Franklin done from the Thomas Sully portrait in the possession of the Institute.
3. That the medal should be of gold and have an intrinsic value of about seventy-five dollars.
4. That the sum of five thousand dollars should be provided by him to be held in trust in perpetuity to be a foundation for this medal, and to be known as The Franklin Medal Fund (Founded January 1, 1914, by Samuel Insull, Esq.).
5. That the interest of this fund should be used from time to time in awarding The Franklin Medal to those workers in physical science or technology, without regard to country, whose efforts have, in the judgment of the Institute, done most to advance a knowledge of physical science or its applications.
6. That any excess of income from this fund, beyond such average annual sum as might be deemed necessary by the Institute for the number of medals it is considered best to award, might be used for premiums to accompany the medals.

The Elliott Cresson Medal.—Under date of February 18, 1848, Elliott Cresson, Esq., of Philadelphia, Pennsylvania, conveyed to the Trustees for The Franklin Institute one thousand dollars of the six per cent. convertible loan of the President, Managers and Company of the Schuylkill Navigation Company—to hold the said sum and the interest to accrue thereon, for the following uses and purposes:

1. The trustees to keep the principal invested as it now (1848) is until it is reimbursed by the said Company, and immediately after such reimbursement to reinvest the said principal of one thousand dollars in such securities, bearing interest, as may by law be designated for the investment of trust funds. And from time to time, as the said principal sum may be reimbursed, to reinvest the same in like manner.

2. To cause suitable dies to be prepared for striking the gold medal out of the first sufficient moneys received for interest on the said sum of one thousand dollars, the dies to bear the following devices and inscription: The obverse,—a medallion likeness of the said Elliott Cresson with inscription around the margin, "Elliott Cresson Medal, A.D. 1848." Reverse,—around the margin, "Awarded by The Franklin Institute of Pennsylvania." The centre to be filled by engraving the name of the party to whom awarded and the year in which the award is made.

3. After the said dies have been prepared, and paid for out of the money received for interest, the said Trustees to cause to be struck, from time to time, such number of gold medals as the interest received will pay for, and to deliver the same to the Treasurer of The Franklin Institute, to be by him transmitted to such persons or parties as the said Franklin Institute may have awarded the same; the said awards, however, to be in all instances made either for some discovery in the arts and sciences, or for the invention or improvement of some useful machine, or for some new process or combination of materials in manufactures, or for ingenuity, skill or perfection in workmanship.

The Howard N. Potts Medal.—Howard N. Potts, Esq., of Philadelphia, Pennsylvania, died July 24, 1906, leaving a will in which he provided for the establishment of this medal as follows:

"I give and bequeath to The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts and its successors, the sum of one thousand dollars, without deduction for taxes or charges; in trust to invest the same and apply the income thereof or such part or portion of it as may be adequate for the purpose, from time to time, to the purchase of a gold medal, to be awarded in the name of the said Franklin Institute for distinguished work in science or the mechanic arts."

The Louis E. Levy Medal.—Under date of December 12, 1923, the following letter was received from Mr. Lionel F. Levy, a member of the Committee on Science and the Arts:

"To The Board of Managers of

"The Franklin Institute of The State of Pennsylvania,

"Philadelphia, Pennsylvania.

"Gentlemen:

"Understanding from my associates on your Committee on Science and the Arts that a feeling obtains among them that the purposes of the Institute would be aided should there be available to the Institute a medal for the recognition of contributions to the JOURNAL, I take the liberty of addressing you to say that my brother, Mr. Howard S. Levy, my sister, Miss Hortense Levy, and I will be glad to found a medal in memory of our Father, the late Louis E. Levy, under the following general conditions:

"First: That we furnish a sum not exceeding five hundred (\$500) dollars to cover the cost of an appropriate design and the necessary dies and diplomas.

"Second: That the medal be of gold and have an intrinsic value of about sixty (\$60) dollars.

"Third: That we furnish the sum of two thousand (\$2000) dollars to be known as the Louis E. Levy Medal Fund.

"Fourth: That the interest on this fund shall be used from time to time in awarding the Louis E. Levy Medal for papers contributed to the JOURNAL of the Institute, descriptive of the author's researches in physical science or of his engineering achievements, which have added largely to the sum of knowledge or aided greatly the well-being of mankind.

"Fifth: That any excess of income from this fund beyond that necessary for the number of medals which the Institute may think best to award shall be added to the Louis E. Levy Library Fund.

"I am,

"Very truly yours,

"(Signed) LIONEL F. LEVY."

This matter was brought to the attention of the Board of Managers at their meeting on December 12, 1923, and the proposed fund was accepted.

The George R. Henderson Medal.—Under date of September 24, 1924, the following communication was presented to the Acting Secretary:

"I herewith present to The Franklin Institute the sum of two thousand five hundred dollars (\$2500). Of this amount a sufficient sum is to be used for the cost of preparing dies for a medal to be known as the George R. Henderson Gold Medal which is to be awarded by the Institute on the recommendation of the Committee on Science and the Arts for meritorious inventions or discoveries in the field of railway engineering. The remaining amount is to constitute a fund in trust, the net income from which, or such portion thereof as may be needed, shall be used for the purchase of the said gold medal as required.

" Any accumulation after providing the medals shall, after each period of five years, be added to the trust fund, and if this fund increases to double the original amount, one-half the net income may be used to provide the Henderson Medal for inventions in other fields than railway engineering.

" (Signed) VIRGINIA P. C. HENDERSON."

This was presented to the Board of Managers for consideration at their meeting on October 8, 1924, and was duly accepted.

The Edward Longstreth Medal.—In the month of May, 1890, Edward Longstreth, Esq., of Philadelphia, Pennsylvania, retired member of The Baldwin Locomotive Works, deposited with The Franklin Institute in trust, a registered bond of the Baltimore Traction Company for the sum of one thousand dollars, for the founding and perpetuation of the Edward Longstreth Medal of Merit; the interest accruing from said principal sum to be used in procuring and awarding said medals for the encouragement of invention, and in recognition of meritorious work in science and the industrial arts; the said awards to be made by The Franklin Institute through its Committee on Science and the Arts, under such rules as said Committee may adopt.

This donor further presented to The Franklin Institute twelve silver medals and the die therefor designed and executed under the direction of a committee of the Institute with his approval.

On May 14, 1890, the Board of Managers of The Franklin Institute, by resolution, accepted on behalf of the Institute the gifts of the donor, and on September 17, 1890, the Institute, by resolution following, confirmed the acceptance:

" *Resolved*, That the Institute hereby confirms the action of the Board of Managers in accepting the gift of foundation of the Edward Longstreth Medal of Merit, and in expressing its grateful acknowledgments for the gift.

" *Resolved*, That the grant of the Edward Longstreth Medal, in accordance with the wishes of the donor, be entrusted to the Committee on Science and the Arts, subject to such conditions as the said Committee, with the approval of the Institute, may propose."

The obverse of the medal bears the effigy of the donor, and is inscribed around the margin, "The Edward Longstreth Medal of Merit, Founded 1890." On the reverse is inscribed around the margin, "Awarded by The Franklin Institute," and in the centre is engraved the name of the recipient with the date and object of award.

On March 19, 1913, Charles Longstreth, son of the above-named Edward Longstreth, deposited with The Franklin Institute the further sum of one thousand dollars to be added to the original fund to be kept with it in trust in perpetuity, the interest to be used as is the interest of the original fund.

The Certificate of Merit.—At the stated meeting of the Institute, held on June 21, 1882, the following resolution was adopted:

" *Resolved*, That the Committee on Science and the Arts of The Franklin Institute is hereby authorized to award, and issue to persons by said Committee adjudged worthy, a Certificate

of Merit for their inventions, discoveries or productions, which certificate shall read as follows:

"The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, awards to _____ this Certificate of Merit. This award is made pursuant to the recommendation of the Committee on Science and the Arts.

"Report No. _____ Approved, _____ 19 _____

"_____ President.

"[SEAL]

"_____ Secretary.

"Chairman of the Committee on Science and the Arts.'"

The Boyden Premium.—On March 23, 1859, Uriah A. Boyden, Esq., of Boston, Massachusetts, deposited with The Franklin Institute the sum of one thousand dollars to be awarded as a premium to any resident of North America who shall determine by experiment whether all rays of light, and other physical rays, are or are not transmitted with the same velocity.

The problem has been more specifically defined by the Board of Managers, as follows:

"Whether or not all rays in the spectrum known at the time the offer was made, namely, March 23, 1859, and comprised between the lowest frequency known thermal rays in the infra-red, and the highest frequency known rays in the ultra-violet, which in the opinion of the Committee lie between the approximate frequencies of 2×10^{14} double vibrations per second in the infra-red and 8×10^{14} in the ultra-violet, travel through free space with the same velocity."

An award, made during the year 1907, covered the solution of the problem so far as the transmission of the visible and ultra-violet rays is concerned. It has been directed by the Board of Managers that the balance of the fund be retained, to be awarded to such person as shall demonstrate whether or not the infra-red rays are or are not transmitted with the same velocity as the other rays.

REGULATIONS OF THE COMMITTEE ON SCIENCE AND THE ARTS

ARTICLE I.—*Investigations*

SECTION 1. The Committee shall investigate, by sub-committee or otherwise, any subject referred to it by the Institute or by any of its sections; and upon a majority vote of the members present at any stated meeting, it may investigate any subject presented on motion of a member or by application as herein provided.

SEC. 2. Secret processes or compounds will not be considered by the Committee; nor will the treatment of materials by any substance be considered, unless the composition used and the method of treatment are fully disclosed.

SEC. 3. A request or a recommendation for the investigation of a subject shall be made in writing addressed to the Secretary who will submit it with full detailed information to the Sub-Committee on New Subjects and Preliminary Examination. If this Sub-Committee recommends it as a suitable subject for investigation to the Committee on Science and the Arts, and if this recommendation is adopted by the General Committee, the Secretary shall notify the applicant accordingly and furnish an application blank substantially like the form appended.

SEC. 4. It shall not be competent for any member of the Committee on Science and the Arts to be an applicant for investigation unless the subject for investigation be referred to the Committee by a vote of the Institute.

ARTICLE II.—*Meetings of the Committee*

SECTION 1. The Committee shall hold stated meetings at 8 o'clock P.M. on the first Wednesday of each month, excepting July, August and September.

SEC. 2. Special meetings may be called by the Chairman, and shall be called by him upon the written request of five members of the Committee.

SEC. 3. At all meetings of the Committee nine members shall constitute a quorum for transacting general business, but for final action upon a report conferring or recommending an award or for amending the rules of the Committee, a quorum shall consist of not less than fifteen members.

SEC. 4. At its stated meetings the Committee shall proceed in the following

Order of Business:

1. Calling the roll.
2. Reading of the minutes of preceding meeting.
3. Approval of bills.
4. Reading of correspondence.
5. Report of sub-committee on new subjects and preliminary examination.
6. Reports of standing and special sub-committees.
7. Consideration of reports for final action.

8. Reports of sub-committees on investigation, first reading.
9. Deferred business.
10. New business.
11. Adjournment.

ARTICLE III.—*Chairman*

SECTION 1. A Special Committee for nominating a Chairman for the ensuing year, consisting of three recent past Chairmen, shall be appointed at the January Meeting of the Committee, this special committee to report its nomination of a candidate at the February Meeting. At this meeting, additional nominations may be made by any member of the Committee on Science and the Arts. The election shall be by ballot at the same meeting, when the person receiving the highest number of votes shall be declared elected. He shall immediately assume office and shall perform his duties until his successor is installed. He shall not be eligible for election in two successive terms.

SEC. 2. The Chairman shall appoint the members of all sub-committees unless otherwise ordered, and may serve *ex officio* on all sub-committees except those charged with investigations.

SEC. 3. The election of a member as Chairman shall be held to vacate his membership of any and all sub-committees of investigation on which he may be serving, except if he has the report of such Committee prepared or in preparation, in which case he shall complete his work, but when such report is presented for consideration, he shall call on another member to preside while the subject is under discussion.

SEC. 4. The Chairman shall submit to the stated meetings of the Board of Managers in October, December, February, April and June of each year, a report of the number of investigations pending before the Committee, the number disposed of since the last report, with the action taken or award made in each case, and the number and nature of new investigations undertaken since the last report, and such other information as to the work of the Committee as the Board of Managers may require. He shall also report to the stated meetings of the Institute such recent action of the Committee as he may deem of interest.

ARTICLE IV.—*Standing Sub-Committees*

SECTION 1. There shall be appointed each February by the Chairman a sub-committee of not less than five members of the Committee, to be styled the "Sub-Committee on New Subjects and Preliminary Examination." The duties of this sub-committee shall be to keep a general observation of progress made in science and the arts and to report to the Committee subjects adjudged worthy of investigation; to coöperate with the Secretary in keeping the work of the Committee properly before the public, and to recommend at each regular meeting the acceptance or otherwise of all applications for investigation. This sub-committee shall meet at least once prior to each regular meeting of the Committee.

SEC. 2. There shall be appointed each February by the Chairman, from the membership, a sub-committee styled the "Sub-Committee on Literature," consisting of six members. It shall be the duty of this sub-committee to examine carefully all papers that are published in the Institute's JOURNAL during

the current calendar year, and to report to the Committee not later than January of the following year, which, if any, of those papers deserve the award of the Louis Edward Levy Medal.

SEC. 3. There shall be appointed by the Chairman from the membership each February, a sub-committee styled the "Sub-Committee on Awarding the Franklin Medal," the duty of which shall be to make recommendations of the award of this medal under the provisions of the deed of gift.

ARTICLE V.—*Sub-Committees on Investigation of Applications*

SECTION 1. Upon the acceptance of an application for investigation, a sub-committee shall be appointed by the Chairman to conduct the investigation.

SEC. 2. Sub-committees shall be appointed from the membership of the Committee, but they may include a minority of other persons whose expert services are desired in the examination.

SEC. 3. When the personnel of a sub-committee on investigation is finally determined, a notice shall be sent to all members thereof giving the names of the members of the sub-committee.

SEC. 4. No person who is interested in the issue shall be a member of the sub-committee on investigation.

SEC. 5. An applicant for investigation may withdraw his application at any time before final action by the Committee; which withdrawal shall be reported to the Committee.

SEC. 6. When the Secretary has obtained the necessary information from the applicant, he shall notify the sub-committee, who shall then proceed with the investigation.

SEC. 7. Correspondence between the sub-committee and the applicant must be carried on through the office of the Secretary, in order that the official records shall be complete.

SEC. 8. Sub-committees shall whenever possible make direct examination and tests of the subject under investigation, and shall not accept tests, data or information furnished by others without first satisfying themselves as to the accuracy thereof. They shall in no case recommend an award solely on the basis of tests, data or information furnished by parties in any way interested in the subject of the award. When data submitted by persons not members of the sub-committee are included in the latter's report, it shall be so stated.

SEC. 9. Sub-committees must ascertain that articles, processes, products, etc., examined are genuine samples of the subject under investigation.

SEC. 10. Each sub-committee on investigation shall report its progress to the Committee at intervals of not more than two consecutive stated meetings; and any sub-committee failing so to report for four consecutive stated meetings may be discharged from further consideration of the subject at the discretion of the Chairman, who shall then appoint a new sub-committee to continue the investigation.

SEC. 11. Any member of a sub-committee on investigation failing to discharge his duties may be replaced by another member at the discretion of the Chairman.

SEC. 12. Sub-committees may request applicants to furnish drawings, diagrams or other exhibits for the purpose of investigations and for the records of the Committee.

SEC. 13. When it is found that the subject under investigation has become involved in litigation, the sub-committee shall defer further action until the litigation is terminated, or the Committee decides that the sub-committee may proceed.

ARTICLE VI.—*Sub-Committee Meetings*

SECTION 1. A quorum for the transaction of business at any meeting of a sub-committee, properly called, shall consist of the one or more members present.

SEC. 2. No applicant or other person interested in the issue of an investigation shall be present at a meeting of a sub-committee or of the Committee except at the invitation of the sub-committee charged with the investigation.

ARTICLE VII.—*Sub-Committees' Reports*

SECTION 1. Reports of progress and final reports of sub-committees shall be made to the Committee in writing. Final reports shall begin and end substantially as indicated in Form B hereto appended.

SEC. 2. When a sub-committee on investigation deems the subject upon which it reports worthy of an award of the Elliott Cresson Medal, the George R. Henderson Medal, the Howard N. Potts Medal, the Edward Longstreth Medal or the Certificate of Merit, it shall include in its report a recommendation to that effect; and such recommendation may be adopted by a majority vote of the Committee, but shall not be changed except by a vote of two-thirds of the members present.

SEC. 3. A report of a sub-committee on investigation, before its acceptance by the Committee, may be edited by the Secretary of the Institute in conjunction with the Chairman of the sub-committee, but without changing its meaning or effect.

SEC. 4. A report of a sub-committee on investigation, before its acceptance by the Committee, shall be signed by a majority of the members of the sub-committee charged with the investigation.

SEC. 5. Any member or members of a sub-committee may file a minority report at least three days prior to the meeting at which the majority report is to be presented.

SEC. 6. No member of a sub-committee shall be permitted to sign a report without having personally examined the subject under investigation, or taken part in its discussion at a meeting of the sub-committee.

SEC. 7. Reports of sub-committees on investigation shall be accompanied by such drawings, diagrams or other exhibits as will serve to elucidate the subject.

SEC. 8. All exhibits pertaining to reports shall be numbered, marked for identification, and signed by the Secretary of the Institute in substantially the following form, and the seal of the Institute shall be impressed thereon:—

Exhibit No. ———, pertaining to report of the Committee on Science and the Arts No. ———

Secretary.

SEC. 9. After the report of a sub-committee on investigation has passed its first reading before the Committee, a copy of its descriptive portion may be furnished the applicant, who may make an explanation or objections, in writing, addressed to the Chairman of the Committee; but such writing must be received not later than the next stated meeting of the Committee.

SEC. 10. The report of a sub-committee on investigation may be discussed and amended at the meeting of the Committee at which it is first presented, but shall be laid over for a second reading and final action until the next stated meeting; except where no recommendation of an award is made in the report, when it may, by a majority vote, be finally disposed of at the time of the first reading.

SEC. 11. Final action on a report of a sub-committee on investigation recommending an award shall not be taken unless at least one member of the sub-committee who signed the report is present.

ARTICLE VIII.—*Reconsideration*

SECTION 1. Upon the adoption of a report of a sub-committee, a motion for reconsideration must be made within the next three months. If such a motion is made and accepted, a vote of two-thirds of a quorum for final action shall be required to change the report as previously adopted.

SEC. 2. A second investigation of a subject shall not be ordered except on a vote of two-thirds of the members present at a stated meeting.

ARTICLE IX.—*Advertisement of Recommendations*

SECTION 1. Upon the adoption, by the Committee on Science and the Arts, of a report of a sub-committee on investigation setting forth that a discovery, invention, improvement or manufacture is worthy of an award of the Elliott Cresson Medal, the Howard N. Potts Medal or the George R. Henderson Medal, publication shall be made in three successive issues of the JOURNAL OF THE FRANKLIN INSTITUTE, stating that at the expiration of three months from the date of the first publication, the person making such discovery, invention, improvement or manufacture shall be entitled to receive the award of the said medal, unless within the time satisfactory evidence shall have been submitted to the Committee on Science and the Arts of the want of originality or merit, in the supposed discovery, invention, improvement or manufacture.

SEC. 2. The adoption by the Committee on Science and the Arts of a report of a sub-committee recommending an award of the Franklin Medal, the Louis Edward Levy Medal, the Edward Longstreth Medal or the Certificate of Merit, shall be conclusive without advertisement.

ARTICLE X.—*Protests*

SECTION 1. Protests against recommendations advertised by publication in the JOURNAL must be received within three months of the date of first publication. Such protests shall be presented to the Committee at its next stated meeting following date of receipt, and shall be affirmed only by a vote of two-thirds of a quorum for final action, in which case a re-investigation shall be made.

ARTICLE XI.—*Institute Reports*

SECTION 1. Reports issued by the Institute shall begin and end substantially as in Form C appended. They shall be written upon an official form provided by the Institute.

SEC. 2. Reports when issued shall state that they are the action of The Franklin Institute by its Committee on Science and the Arts. They shall be attested by the President and the Secretary of the Institute and by the Chairman of the Committee, and shall be impressed with the seal of the Institute; and they may also bear the names of the members who signed the sub-committee's report.

ARTICLE XII.—*Amendments to Regulations*

SECTION 1. Proposals to amend these regulations shall be presented to the Committee in writing, signed by at least two members. They may be considered when presented, but shall not be acted upon until the next stated meeting after presentation, and shall then be adopted if agreed to by two-thirds of the required quorum.

SEC. 2. Notice of proposed amendments shall be sent to each member on the programme for the meeting at which they may be acted upon.

Since much latitude is allowed by the terms of the several medal bequests and no rules for the making of Institute awards conflicting with the purpose and intent of the donors can be made, it is obviously not the part of wisdom to attempt too much in the way of definition. It is suggested that future awards be made with the following general understanding:

1. That the Certificate of Merit be awarded for meritorious inventions and physical processes.

2. That the Edward Longstreth Medal be awarded for invention of high order and for particularly meritorious improvements and developments in machines and mechanical processes.

3. That the Howard N. Potts Medal be awarded in recognition of important discoveries in physical science.

4. That the George R. Henderson Medal be awarded in recognition of meritorious inventions or discoveries in the field of railway engineering.

5. That the Elliott Cresson Medal be awarded in recognition of inventions of signal value and fundamentally important in the arts and industries.

6. That the Louis Edward Levy Medal be awarded in recognition of papers contributed to the JOURNAL of the Institute, which are of superior excellence and descriptive of a field in science or engineering to which the author has contributed fruitful research.

7. That the Franklin Medal continue to be awarded to those whose efforts have contributed most to a knowledge of physical science and its applications.

REPORT FORMS OF COMMITTEE ON SCIENCE AND THE ARTS

FORM A

(Application for Investigation) THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS

In the matter of your application to The Franklin Institute for a consideration of your invention or discovery entitled the following data are requested for the information of the Committee on Science and the Arts:

1. What is the specific purpose of the invention?
2. What is the condition of the prior art in this regard?
3. What improvement is claimed to be effected by the invention?
4. How is the improvement effected?
5. What patents, if any, have been issued for this invention?
6. What citations, if any, were made in this regard by the Patent Office before allowance of patent claims?
7. Is the invention now in actual use?
8. If so, since when?
9. Where may it be seen in operation?
10. Are you prepared to submit drawings of the apparatus or device?
11. Are you prepared to submit a model of the apparatus or device?
12. If the invention is a composition of matter, are you prepared to submit specimens of the ingredients and of the compound sufficient for the purpose of experiments?
13. If the invention is a chemical process, are you prepared to give a demonstration of the same?

IMPORTANT TO APPLICANT

This application carefully filled in and other available matters descriptive of the invention or process, together with two copies of each of the United States patents issued to applicant, must be returned promptly to the Secretary of The Franklin Institute, 15 South Seventh Street, Philadelphia, Pa.

(A copy of Form A, above, may be obtained from the Secretary of the Institute and must be filled in, signed and promptly returned by an applicant for an examination of and a report upon an invention or discovery.)

FORM B

(Sub-committee Report Form)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

S. & A. Case No.

REPORT OF SUB-COMMITTEE, dated

Investigating

TO THE COMMITTEE ON SCIENCE AND THE ARTS:

Your sub-committee appointed to investigate the above subject report
as follows:

.....

In consideration of the {
discovery
excellence of construction
ingenuity and novelty
or

ofyour sub-committee recommends

the award of to of

Respectfully submitted,

..... *Chairman.*

.

.....

.

Adopted at the Stated Meeting of 19

YEAR BOOK OF
FORM C
(Institute Report Forms)
THE FRANKLIN INSTITUTE
OF THE
STATE OF PENNSYLVANIA
FOR THE
PROMOTION OF THE MECHANIC ARTS

HALL OF THE INSTITUTE,
Philadelphia,.....

S. & A. Case No.

The Franklin Institute of the State of Pennsylvania, acting through its
Committee on Science and the Arts, investigating
..... reports as follows:

In consideration of the { discovery
excellence of construction
ingenuity and novelty
or

of the Institute awards the.....

to of

[SEAL] President.

..... Secretary.

Countersigned

Chairman of the Committee on Science and the Arts.

PRESIDENT'S REPORT AND REPORTS OF THE COMMITTEES OF THE INSTITUTE AND THE COMMITTEES OF ITS BOARD OF MANAGERS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1924

REPORT OF THE PRESIDENT

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1924

To the Members of The Franklin Institute:

Your Board of Managers has instructed me to report to you upon the affairs of the Institute for the year ending September 30, 1924.

Following the practice of past years, the Board's report quotes briefly from the reports of the Committees of the Institute and of its Board of Managers:

The Committee on Museum (Dr. Alexander E. Outerbridge, Jr., Chairman) reports that our Museum has been enriched by a number of models, pieces of apparatus, medallions and photographs—all of great historical and scientific value. Evidencing the international interest in the Institute, it is noted that these additions include medallions of George Washington, Benjamin Franklin and the Prince of Wales, cast in Hadfield manganese steel, which were presented by Sir Robert Hadfield; also a photograph of a painting in oil of Doctor Franklin which for nearly one hundred years has been in the possession of the Royal Technical College of Glasgow, Scotland. This portrait was presented by Mr. H. F. Stockdale, its Director. The Museum continues to serve as a highly useful adjunct of the Institute.

The Committee on Publications (Dr. George D. Rosengarten, Chairman) reports that the issuance of the December, 1924, number of the JOURNAL OF THE FRANKLIN INSTITUTE completed its 198th Volume. The Committee also makes a comparison of that number of the JOURNAL with the first JOURNAL issued in 1826: At that early date the emphasis was placed upon the material things that could be seen, handled and used in industrial pursuits, the results being shown in the outstanding progress which had been made. This is in striking contrast with the record in recent issues of the JOURNAL, which presents the determined attack being made to-day upon the constitution of matter. For example, the sixty-four pages of the first volume of the JOURNAL contain such topics as the proposed exhibition of October, 1826, with a list of sixty-one prizes to be awarded for such practical purposes as "the best stove or grate for burning anthracite; the best soft iron castings; the best black broadcloths; the best beaver hat, price nine dollars, etc." Contrasted with these topics, we find, in the one hundred and forty pages of the December, 1924, JOURNAL, articles on "The Natural and Artificial Disintegration of the Elements," "The Application of Positive Ray Analysis" and "The Optical Projection of the Tracks of Alpha Particles." During the year 3000 copies of the collected articles, previously printed in the JOURNAL, on the "Electron in Chemistry," by Sir Joseph J. Thomson, were issued in book-form, and 2059 copies were sold. Also, 277 additional copies of Dr. W. J. Humphreys' lectures on "Physics of the Air" were sold. This indicates that the policy of the Institute in making

available, in book-form, notable lectures delivered before its members, has been very well received.

The report of the Committee on Meetings (Dr. Gellert Alleman, Chairman) contains a list of the lectures arranged by this Committee, showing that the meetings of the Institute during the past year have been very carefully arranged, and always selected with a view of presenting to the Institute members the latest and most authoritative information on the progress in science and industry. At the meeting held on the afternoon of May 21, 1924, The Franklin Medal, accompanying Certificate, and Certificate of Honorary Membership, were awarded to Sir Ernest Rutherford, F.R.S., Cavendish Professor of Physics, Cambridge University, Cambridge, England, in recognition of his "long-continued and fruitful researches, signally contributing to the present state of knowledge of the elements, their constitution and relationships." In Sir Ernest's absence, these awards were accepted in his behalf by H. G. Chilton, Esquire, C.M.G., Counsellor of the British Embassy, Washington. The Franklin Medal, accompanying Certificate, and Certificate of Honorary Membership, were also awarded to Dr. Edward Weston, of Newark, New Jersey, in recognition of his "discoveries and inventions in the field of electricity, immeasurably fruitful and fundamental, contributory to the establishment of the electric art." Unfortunately, Doctor Weston could not be present, on account of illness, and these honors were accepted for him by Dr. L. H. Baekeland, President of the American Chemical Society. In all, there were eight stated meetings of the Institute held on the third Wednesday of each month, from October to May inclusive, at which there was a total attendance of 1053. Sixteen other lectures were held during the same period, with a total attendance of 1894. This represents a very good average attendance at the meetings and lectures. Of course it must not be forgotten that the benefit reaches a still larger number through the medium of the Institute JOURNAL. All of the efforts of this Committee therefore are well worth while.

The Committee on Library (Mr. W. H. Fulweiler, Chairman) reports accessions for the year, of 831 bound volumes, 174 unbound volumes, and 1191 pamphlets, making a total increase for the year of 2196 publications. In addition to purchases these include gifts from members of the Institute and from other individuals. The Institute is also under obligation to various Government Departments, State and municipal officials, and to the numerous organizations who have, from time to time, supplied the Library with publications on technical subjects. To all of these the Institute is glad to record its appreciative thanks. The Committee also reports that the Library was maintained at its usual high standard by the binding of periodicals and the rebinding of old volumes, etc., and by continuing and increasing the number of exchanges of the JOURNAL for the publications of other scientific institutions. With its 82,941 volumes, 20,655 pamphlets, 2292 maps and charts, 1356 photographs and 784 original drawings and designs, our splendid Library is of priceless value not only to the members of the Institute, but to all scientists and engineers, and even the general public.

The Committee on Science and the Arts (Mr. George H. Benzon, Jr., Chairman) reports that final disposition was made of eighteen cases, eleven of which received awards. This Committee also reports two noteworthy gifts:

First, the establishment of the Louis Edward Levy Medal Fund of \$2500, contributed by the family of the late Louis Edward Levy, in commemoration of his long and valued service to the Institute through its Committee on Science and the Arts. The income of this fund is to be used for a medal which will be awarded for a paper published in the JOURNAL based on a presentation of original work treated in the paper. The first Levy Medal was awarded to Dr. Harvey Fletcher, of the American Telephone and Telegraph Company of New York. Second, the establishment of the George R. Henderson Medal Fund of \$2500, contributed by Mrs. George R. Henderson, in memory of her husband, who was an active and valuable member of the Committee on Science and the Arts from 1912 until 1921. The income from this fund is to be used for medals to be awarded for inventions and improvements in railway engineering. The awards of the two Franklin Medals at the May Meeting to Sir Ernest Rutherford and to Dr. Edward Weston were made upon the recommendation of this Committee. The Committee changed its office from the Institute Building, on Seventh Street, to a room in one of the buildings on Nineteenth Street. A meeting room, equipped with a projection lantern, has also been provided for the Committee at the Nineteenth Street Building. The Committee suffered a serious loss during the past year in the death of four of its most active and loyal members: Dr. Harry F. Keller, Mr. Edward V. McCaffrey, Mr. Charles W. Masland and Dr. Roger F. Brunel. Their untiring efforts in advancing the work of the Institute will be very keenly missed.

The Committee on Election and Resignation of Members (Mr. R. W. Lesley, Chairman) reports that 74 new members were elected during the year and that the net increase in membership was 27. The total number of members of the Institute, of all classes, is 1378. Under plans now being considered by the Board, it is hoped that the number of new members, particularly among the younger men, may be very considerably augmented in the near future.

The Committee on Endowment (Mr. G. H. Clamer, Chairman) reports that two endowments were received during the year, namely: The Louis Edward Levy Medal Fund of \$2500, and the George R. Henderson Medal Fund of \$2500.

The report of the Committee on Stocks and Finance (Mr. Walton Forstall, Chairman) checks closely with the anticipated requirements of the Institute's work as forecast by the Committee. To comply with the change in the By-Laws, the Board of Trustees has resigned, and the Finance Committee and the fiscal agent, the Fidelity Trust Company, have assumed charge of the funds of the Institute. The total expenses of the Institute for the year ending September 30, 1924, were \$67,327.02, and the income was \$48,844.62, leaving a deficit of \$18,482.40, which the Committee has provided for by loans, as has been the practice in the past. It is anticipated that this deficit will be very materially reduced during the coming year.

Audit. Lybrand, Ross Bros. & Montgomery, certified public accountants, have audited the accounts of the Institute for the fiscal year ended September 30, 1924, and report them to be correct.

The Bartol Research Foundation Committee (Mr. C. C. Tutwiler, Chairman) reports that the Bartol Foundation is still faced with the difficult problem of securing a suitable Director. It is recognized that the field from

which such a man must be drawn is exceedingly limited, and it is of the utmost importance that the Director selected should be a man possessing such unusual scientific and personal attainments as will enable him to carry out the high aims contemplated in Mr. Bartol's generous bequest. Under the circumstances, the delay in starting the work will be appreciated. It is expected, however, that the selection of a Director will be made within a short time, possibly before this report is received, and it is felt that the delay will be more than compensated for in the selection of one, who is likely to put the Foundation in a favorable position with similar institutions.

In the meanwhile, all possible expense at the Foundation has been curtailed, and very considerable sums from income are being added to the principal of the bequest for future use.

The outstanding event of this past year was the Centenary Celebration of the Founding of the Institute and the Inauguration Exercises of the Bartol Research Foundation, held September 17th, 18th, and 19th, during which the Institute was honored by the presence of delegates from universities, scientific associations, and industrial organizations from this country and abroad. It was the most brilliant gathering of scientists that has probably ever been held in the United States. The purpose of this Celebration was to have a record of science in the year 1924. This was accomplished by the presentation of papers on chemistry, physics and engineering, by the world's leading scientists. The complete program of the Centenary Celebration giving the titles of the addresses and papers with the names of the speakers was published in the September issue of the *JOURNAL*. Monographs of the addresses and papers have since been issued. Many of these papers have been asked for by colleges and universities for the purpose of their employment as texts in various courses. A number of the recipients of these monographs have sent appreciative letters.

Some idea of the popular interest manifested in these publications may be gained by the fact that one address—that of Dr. Arthur D. Little, entitled "The Fifth Estate"—has been printed in eighteen different journals, the issues of which total approximately three million copies. Three volumes containing the complete proceedings of the Centenary Celebration are now in course of preparation, and will be available shortly.

Under the title, "Modern Views of Physical Science," Dr. Elwood Hendrick has described, in a most interesting manner, the details of the Centenary Celebration. Doctor Hendrick's book constitutes a permanent, but brief, record of the various meetings.

The Centenary Committee under the able chairmanship of Dr. Gellert Alleman, with Mr. Henry Howson as its Treasurer and Dr. Walton Clark, Mr. C. C. Tutwiler and your President as the other members, planned and carried out the program. The magnitude of the labors assumed by Doctor Alleman may be appreciated when it is stated that it involved correspondence with leading scientists all over the world, the reception and entertaining of the guests and delegates, the selection of appropriate lecture rooms and auditoriums, and careful attention to a host of other details. Our guests were unstinted in their praise of Doctor Alleman's efforts in providing for their every comfort. Mr. Henry Howson, as the Treasurer of the Committee, spent much time

and effort in obtaining contributions to defray the expenses of the Celebration; and his success enabled us to meet all of these expenses without drawing upon the regular funds of the Institute.

The Walnut Street Theatre was a very convenient and suitable auditorium for the opening ceremonies of the Celebration. Rain had prevented the scheduled academic procession from the Institute building to the Theatre, but in the assemblage of guests and delegates in their brightly colored academic gowns, the gloom of the unfavorable weather conditions was quickly dispelled. Upon this occasion it was fitting to have the invocation delivered by the Rev. Dr. Louis C. Washburn, Rector of Christ Church, Philadelphia, the church in which Benjamin Franklin attended worship; to have the address of welcome made by the Honorable W. Freeland Kendrick, Mayor of Philadelphia, the city where Doctor Franklin spent most of his life; and to have Dr. Elihu Thomson, a member of the Institute for over fifty years, and Honorary Chairman of the Centenary Celebration, give a notable historical address on The Franklin Institute, founded to perpetuate the ideals of Franklin.

The University of Pennsylvania extended to us the privilege of using its lecture rooms, and the University Museum permitted us to use its main auditorium for the three days of the Celebration. This enabled the proper presentation of the addresses and papers, especially as the lecture rooms were provided with the necessary equipment for demonstration purposes. The University also placed at our disposal the use of its dormitories, which added very much to the comfort of our guests at the Centenary Celebration.

The Academy of Natural Sciences courteously allowed us to use its meeting room for one of the sessions.

The Philadelphia Country Club with its beautiful grounds and clubhouse enabled us to hold a delightful Garden Party on Thursday afternoon, September 18th, in honor of our guests and delegates.

A distinguished group of delegates and guests and members of the Institute assembled at 127 North Nineteenth Street on Friday morning, September 19th, to attend the formal Inauguration Exercises of the Bartol Research Foundation. Accompanied by her mother, Mrs. H. Allen Dalley, of Haverford, Teresita Bartol Dalley, thirteen-year-old grandniece of Mr. Bartol, gracefully performed the ceremony of unveiling a marble tablet to commemorate the munificent bequest of Henry Welchman Bartol, which has made possible the establishment of research laboratories at this location. This tablet bears an intaglio portrait of Mr. Bartol, and is inscribed as follows:

1847 1918
IN HONORED MEMORY OF
HENRY WELCHMAN BARTOL
WHO CREATED AND ENDOWED
THE HENRY W. BARTOL FOUNDATION
OF THE FRANKLIN INSTITUTE
FOR THE CONDUCT OF RESEARCHES IN THE
PHYSICAL SCIENCES
AND FOR THE INVESTIGATION OF PROBLEMS OF
A SCIENTIFIC NATURE ARISING IN THE INDUSTRIES

An address appropriate to the occasion was made by Mr. C. C. Tutwiler, a Vice-President of the Institute and Chairman of the Bartol Research Foundation Committee.

An unusual feature of the Celebration was the Convocation held at the University of Pennsylvania on Friday afternoon, September 19th, when the President and Provost of the University, Dr. Josiah H. Penniman, assisted by the Vice-Provost, Dr. J. Hartley Merrick, conferred the Honorary Degree of Doctor of Science upon Sir William Henry Bragg, of the Royal Institution, London; Professor Charles Fabry, of the University of Paris; Sir Charles A. Parsons, of the Institution of Naval Architects, London; Dr. E. W. Rice, Jr., Honorary Chairman of the Board of Directors of the General Electric Company; Professor Pieter Zeeman, of the University of Amsterdam; and your President.

The Banquet held in the Ball Room of the Bellevue-Stratford on Friday evening, September 19th, was a gala occasion and a memorable conclusion to the Centenary Celebration.

The funds which made it possible for the Institute to carry out its Centenary Celebration in this noteworthy manner, were the result of liberal contributions from many industries and individuals. We are glad to record our thanks to these contributors for their generous assistance.

The proceedings of the Celebration received wide publicity in the daily newspapers and the technical press, and unquestionably this has more firmly established in the public mind an appreciation of the work of the Institute.

The outstanding success of the Centenary Celebration was due to the coöperation of the members, Board of Managers, and the Officers of the Institute, and to the whole-hearted assistance which we received from the various sources mentioned.

The official staff has undergone some changes. Dr. R. B. Owens resigned as Secretary of the Institute and Director of the Bartol Research Foundation, as recorded in the January, 1925, issue of the JOURNAL. Mr. T. R. Parrish, Actuary and Assistant to Doctor Owens, resigned to accept a position in the business world. Dr. George A. Hoadley was elected Acting Secretary and Editor of the JOURNAL. Mr. Alfred Rigling was elected Assistant Secretary and Assistant Editor of the JOURNAL, and also retains the position of Librarian. Mr. W. F. Jackson, Jr., was appointed to the office of Controller, formerly known as Actuary, and all of the accounting and allied work of the Institute, including that of the Bartol Research Foundation, has been placed in his charge.

It has been a real pleasure and privilege to me to serve the Institute as its President during the past year. In the work of this office, which otherwise might have become a serious burden, I have received the greatest measure of assistance and coöperation from the officers and the Board of Managers, from the Chairman and members of the Committees and from the staff of the Institute. I wish to record especially my appreciation of the invaluable aid and counsel rendered to me by my predecessor, Dr. Walton Clark. His long experience as the President of the Institute for seventeen years, he has unreservedly placed at my disposal at all times. This intimate association with Doctor Clark has been most agreeable and inspiring to me.

Another century of opportunity now lies before the Institute. With the

increased funds which we hope will come to us more and more through gifts and bequests, with modern buildings equipped with laboratories and other necessary facilities for our work, and with a greatly enlarged membership, the Institute will be able to accomplish even greater things than it has achieved in the past.

Respectfully submitted,

WM. C. L. EGLIN,
President.

PHILADELPHIA, January 14, 1925.

REPORT OF THE COMMITTEE ON LIBRARY

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1924

To the President and Members of The Franklin Institute:

The Committee on Library respectfully submits the following statement of activities in the library during the year ending September 30, 1924.

The additions to the library were as follows:

| Source | Bound Volumes | Unbound Volumes | Pamphlets |
|-----------------------------|------------------|--------------------|-------------|
| By Gift | 196 | 148 | 1187 |
| Binding | 418 | | |
| Purchase | | | |
| Books and Periodicals | 3 | 1 | |
| Jayne Fund | 4 | | |
| Journal | 36 | 13 | 2 |
| Lea Fund | 13 | 3 | |
| Levy Fund | 7 | 3 | |
| Memorial Library Fund | 10 | 3 | |
| Miscellaneous Expense | 8 | 6 | |
| Moore Fund | 48 | 10 | 2 |
| Morris Fund | 50 | | |
| Potts Fund | 8 | | |
| Ware Fund | 14 | 2 | |
| | <u>815</u> | <u>189</u> | <u>1191</u> |

Total additions for the year.....2195

The Committee had at its disposal \$3,050 appropriated by the Board of Managers and \$2,085.81, the income of the various trust funds.

The expenditures for the year were \$1,150 for binding, \$3,326.82 for books and subscriptions to magazines and other periodical publications and \$490.61 for general expenses.

Gifts of books, pamphlets and magazines were received from Mr. Alfred Darrach, Mr. Walton Forstall, Dr. John F. Frazer, Mr. F. Lynwood Garrison, Mr. Clarence A. Hall, Dr. Carl Hering, Mr. John J. L. Houston, Mrs. Harry F. Keller, Mr. Carrol B. Neblette, Mr. Samuel S. Sadtler, Mr. Horace Wells Sellers, Mr. William R. Webster, Mr. Albert O. Young, Messrs. Harris and Richards and the Philadelphia office of the McGraw-Hill Company. The

An address appropriate to the occasion was made by Mr. C. C. Tutwiler, a Vice-President of the Institute and Chairman of the Bartol Research Foundation Committee.

An unusual feature of the Celebration was the Convocation held at the University of Pennsylvania on Friday afternoon, September 19th, when the President and Provost of the University, Dr. Josiah H. Penniman, assisted by the Vice-Provost, Dr. J. Hartley Merrick, conferred the Honorary Degree of Doctor of Science upon Sir William Henry Bragg, of the Royal Institution, London; Professor Charles Fabry, of the University of Paris; Sir Charles A. Parsons, of the Institution of Naval Architects, London; Dr. E. W. Rice, Jr., Honorary Chairman of the Board of Directors of the General Electric Company; Professor Pieter Zeeman, of the University of Amsterdam; and your President.

The Banquet held in the Ball Room of the Bellevue-Stratford on Friday evening, September 19th, was a gala occasion and a memorable conclusion to the Centenary Celebration.

The funds which made it possible for the Institute to carry out its Centenary Celebration in this noteworthy manner, were the result of liberal contributions from many industries and individuals. We are glad to record our thanks to these contributors for their generous assistance.

The proceedings of the Celebration received wide publicity in the daily newspapers and the technical press, and unquestionably this has more firmly established in the public mind an appreciation of the work of the Institute.

The outstanding success of the Centenary Celebration was due to the coöperation of the members, Board of Managers, and the Officers of the Institute, and to the whole-hearted assistance which we received from the various sources mentioned.

The official staff has undergone some changes. Dr. R. B. Owens resigned as Secretary of the Institute and Director of the Bartol Research Foundation, as recorded in the January, 1925, issue of the JOURNAL. Mr. T. R. Parrish, Actuary and Assistant to Doctor Owens, resigned to accept a position in the business world. Dr. George A. Hoadley was elected Acting Secretary and Editor of the JOURNAL. Mr. Alfred Rigling was elected Assistant Secretary and Assistant Editor of the JOURNAL, and also retains the position of Librarian. Mr. W. F. Jackson, Jr., was appointed to the office of Controller, formerly known as Actuary, and all of the accounting and allied work of the Institute, including that of the Bartol Research Foundation, has been placed in his charge.

It has been a real pleasure and privilege to me to serve the Institute as its President during the past year. In the work of this office, which otherwise might have become a serious burden, I have received the greatest measure of assistance and coöperation from the officers and the Board of Managers, from the Chairman and members of the Committees and from the staff of the Institute. I wish to record especially my appreciation of the invaluable aid and counsel rendered to me by my predecessor, Dr. Walton Clark. His long experience as the President of the Institute for seventeen years, he has unreservedly placed at my disposal at all times. This intimate association with Doctor Clark has been most agreeable and inspiring to me.

Another century of opportunity now lies before the Institute. With the

increased funds which we hope will come to us more and more through gifts and bequests, with modern buildings equipped with laboratories and other necessary facilities for our work, and with a greatly enlarged membership, the Institute will be able to accomplish even greater things than it has achieved in the past.

Respectfully submitted,

WM. C. L. EGLIN,
President.

PHILADELPHIA, January 14, 1925.

REPORT OF THE COMMITTEE ON LIBRARY

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1924

To the President and Members of The Franklin Institute:

The Committee on Library respectfully submits the following statement of activities in the library during the year ending September 30, 1924.

The additions to the library were as follows:

| Source | Bound Volumes | Unbound Volumes | Pamphlets |
|-----------------------------|------------------|--------------------|-------------|
| By Gift | 196 | 148 | 1187 |
| Binding | 418 | | |
| Purchase | | | |
| Books and Periodicals | 3 | 1 | |
| Jayne Fund | 4 | | |
| Journal | 36 | 13 | 2 |
| Lea Fund | 13 | 3 | |
| Levy Fund | 7 | 3 | |
| Memorial Library Fund | 10 | 3 | |
| Miscellaneous Expense | 8 | 6 | |
| Moore Fund | 48 | 10 | 2 |
| Morris Fund | 50 | | |
| Potts Fund | 8 | | |
| Ware Fund | 14 | 2 | |
| | <u>815</u> | <u>189</u> | <u>1191</u> |

Total additions for the year.....2195

The Committee had at its disposal \$3,050 appropriated by the Board of Managers and \$2,085.81, the income of the various trust funds.

The expenditures for the year were \$1,150 for binding, \$3,326.82 for books and subscriptions to magazines and other periodical publications and \$490.61 for general expenses.

Gifts of books, pamphlets and magazines were received from Mr. Alfred Darrach, Mr. Walton Forstall, Dr. John F. Frazer, Mr. F. Lynwood Garrison, Mr. Clarence A. Hall, Dr. Carl Hering, Mr. John J. L. Houston, Mrs. Harry F. Keller, Mr. Carroll B. Neblette, Mr. Samuel S. Sadtler, Mr. Horace Wells Sellers, Mr. William R. Webster, Mr. Albert O. Young, Messrs. Harris and Richards and the Philadelphia office of the McGraw-Hill Company. The

Institute is also under obligation to various government departments, state and municipal officials and to the numerous organizations who have from time to time supplied the library with publications on technical subjects.

The contents of the library on September 30, 1924, were:

| | |
|-------------------------------------|--------|
| Volumes, bound and unbound | 82,940 |
| Pamphlets | 20,655 |
| Maps and Charts | 2,292 |
| Photographs | 1,356 |
| Original Drawings and Designs | 784 |

Binding:

During the year the following work was done by the binders:

| | |
|--|-----|
| Recent volumes of periodicals | 383 |
| Patent specifications | 22 |
| 350 pamphlets bound | 24 |
| Volumes charged to the Ware Fund | 4 |
| Old volumes bound | 66 |
| Old volumes rebound | 1 |

Magazines and other periodical publications:

5650 copies of the JOURNAL were distributed for exchange purposes.

26 new exchanges were added to the mailing list and 13 were removed.

The total number of exchanges on September 30 was 504.

The subscriptions totalled 192.

The number of publications received by gift was 103, making the total periodical publications received by the library 799.

No changes have occurred in the library staff during the past year.

Respectfully submitted,

W. H. FULWEILER,
Chairman.

PHILADELPHIA, January 14, 1925.

REPORT OF THE COMMITTEE ON MUSEUM

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1924

To the President and Members of The Franklin Institute:

The following models, apparatus and specimens have been added to the Institute's collection since the date of the last report:

Four-Light Series Brush Arc Generator No. 36, presented to the Institute by the Philadelphia Electrical and Manufacturing Company through Mr. C. L. Bundy, Secretary and Treasurer.

Weston Dynamo, 1876, Brush Dynamo (early form) and Dynamo without name-plate, given by Mr. Julius Boekel.

A collection of switches, meters and other electrical apparatus presented by Mr. J. P. Manypenny, President of the Engineering Equipment Company, Philadelphia.

Medallions of George Washington, Benjamin Franklin and the Prince of Wales, cast in Hadfield manganese steel, presented by Sir Robert Hadfield.

Eastman Kodak camera, about 1884, presented by Mr. Walter B. Smith, member of the Institute.

Wollaston Reflecting Goniometer, presented by Mr. Horace W. Shelmire, Wayne, Pennsylvania.

Boulet Indicator, presented by the Zina Goodell Corporation.

Chronoscope constructed by M. Hipp, Neuchatel, Switzerland, presented by Mrs. Walter M. James.

Photograph of a painting in oil of Doctor Franklin, for nearly one hundred years in the possession of The Royal Technical College, Glasgow, Scotland, presented by Mr. H. F. Stockdale, Director.

Engravings of the United States Bank, Philadelphia, by H. Walton; Custom House, late U. S. Bank, by J. T. Bowen; United States Mint, by J. C. Wild; View of the Water Works at Center Square, Philadelphia, published by H. Quig; Henry Clay, from a daguerreotype by Root; the Cope brothers (Jasper, Thomas P., and Israel), by Thomas B. Welch; General William H. Harrison, President of the United States, 1841, by W. E. Tucker and Charles W. Bender; Daniel Webster, engraved by Andrews and Smith, from a painting by Chester Harding; sheet of vignettes, by Draper, Underwood, Bald and Spencer. Portrait of Alexander I, Emperor of Russia, ruled by Ch. Gobrecht. Memorandum book, the property of Ch. Gobrecht. Given by Mr. Alfred Darrach.

Section of one of the rails laid for the first Electric Railroad in New England, Ansonia-Derby, 1887; Superintendent of Construction, J. D. Kennedy. Presented by Mr. Lucius S. Storrs, President, The Connecticut Company.

Respectfully submitted,

ALEX. E. OUTERBRIDGE, JR.,

PHILADELPHIA, January 14, 1925.

Chairman.

REPORT OF THE COMMITTEE ON MEETINGS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1924

To the President and Members of The Franklin Institute:

There were eight stated meetings during the year ending September 30, 1924. These were held on the third Wednesday of each month, from October to May inclusive, at the hour of eight o'clock, with the exception of that of May 21, which was held at three-thirty o'clock in the afternoon. The following is a list of dates and speakers with titles and synopses of their communications:

October 17, 1923: Arthur L. Day, Ph.D., Director, Geophysical Laboratory and Chairman Advisory Committee in Seismology, Carnegie Institution of Washington, Washington, D. C., presented a paper on "Earthquakes and Volcanic Eruptions," telling of recent studies of earthquake and volcano phenomena and the conclusions to be drawn from them, including the first announcement of results from the study by the Carnegie Institution of Washington of the destructive earthquakes in Chili in November, 1922. The speaker gave some of the results of the study of earth movements in California, obtained through accurate triangulation for the demonstration of surface changes; and by means of colored slides illustrated the differences between the earth move-

ments in California and Chili. References to volcanic phenomena were largely confined to those recently exhibited by Etna, of which a number of colored slides were shown portraying various stages of the several eruptions. At this meeting the Elliott Cresson Medal was awarded to Raymond D. Johnson for his invention of the "Johnson Hydraulic Valve."

November 21, 1923: Rear Admiral William A. Moffett, U. S. N., Chief, Bureau of Aeronautics, Navy Department, Washington, D. C., presented a paper on "ZR-1, the First Helium Filled Dirigible," in which he referred to the cessation of airship building abroad and to the reviving of this art by the American Navy, which constructed the ZR-1, in which is used helium, a non-combustible and non-explosive gas. By use of lantern slides, he pointed out the main structural features of this airship, the arrangement of the gas bags and the location of the motors. He said that naval constructors had turned their hands to airship building and were pioneering for a new industry and a new commercial era in aeronautics. He further referred to the airship as a recent factor in world commerce, and by use of charts pointed out possible airship routes which would greatly aid in speeding up communications and cutting down distances. He also emphasized the importance and value of the airship as a naval unit. At this meeting were awarded the Elliott Cresson Medal to Albert Kingsbury for his invention of the "Kingsbury Thrust Bearing," and the Edward Longstreth Medal to Harry S. Parks for his invention of the "Pneumercator Tank and Draft Gauge."

December 19, 1923: W. F. G. Swann, A.R.C.S., D.Sc., Professor of Physics, University of Chicago, Chicago, Illinois, presented a paper on "The Structure of the Atom," describing the fundamental entities and radiations associated with the modern theory of the atom. He discussed the electron, the proton, and the radioactive radiations; and illustrated his remarks by lantern slides. He also discussed the bearing of spectral and radioactive phenomena on the theory of atomic structure, and touched on the work of Thomson, Rutherford, Aston, Bohr and Sommerfeld in connection with the development of this theory, and spoke of the part played by the theory of relativity in the fine structure of spectral lines. This paper of Doctor Swann's has been published in the March, 1924, issue of the JOURNAL.

January 16, 1924: Charles H. Herty, Ph.D., D.Sc., President, Synthetic Organic Chemical Manufacturers' Association, New York City, presented a paper on "The Coal-Tar Industries of the United States." He pointed out that the United States possesses an abundance of raw material for the development of the coal-tar industries, but prior to the world war economic conditions were such that a large proportion of the coal-tar was wasted or consumed in the raw state. War conditions brought about a blockade against German coal-tar chemicals, and this in turn led to the development of a coal-tar chemical industry in this country. Dyestuffs, medicinals, high explosives, photographic chemicals, synthetic flavoring extracts, perfumes and tanning materials are all finished products emanating from coal-tar. During the past five years the coal-tar chemical industry has grown to an annual production of eighty-eight million pounds, of a total value of fifty-four million dollars, as shown by the United States Tariff Commission annual census. Doctor Herty showed that it is essential that the independence of this country in this line

of manufacture should be maintained, as the industry is a national asset of vital significance from the standpoint of security, of health, and of economics.

February 20, 1924: H. L. Cooke, M.A., Professor of Physics, Princeton University, Princeton, New Jersey, presented a paper on "Aeroplane Surveying," in which he discussed the nature of the information obtainable from air photographs, described the two types of such photographs and outlined the relative merits and limitations of each. He referred to the advantages of wide angle views and said that the determination of aeroplane position is the fundamental problem of topographical survey from the air. He also discussed the nature and complexity of the problem, the three general means of solution and their relative merits. The speaker also described the ways of horizontalizing the views in map drawing, discussed stereoscopic methods and anaglyphic methods; and he reviewed the present state of development and probable lines of progress, pointing out the ultimate limitations of air surveying. The paper was illustrated by lantern slides.

March 19, 1924: Eskil Berg, E.E., M.E., Consulting Engineering Department, General Electric Company, Schenectady, New York, presented a paper on "Pressure, Superheat and Reheating as Affecting Power Plant Economy," inviting attention to several of the largest modern power plants in this country and abroad which have recently adopted working pressures up to five hundred and fifty pounds with reheating and steam extraction. He said that steam boilers and turbines are being built for one thousand to twelve hundred pounds pressure and a maximum temperature of seven hundred and fifty degrees, and discussed the economies in power generation to be effected by the use of such higher pressures and temperatures. After the address of the evening, Mr. John L. Cox, Assistant to the President, the Midvale Steel Company, showed a number of lantern slides and described the manufacture of forged steel steam drums for boilers designed for twelve hundred pounds pressure. Messrs. H. P. Liversidge, Charles Penrose and M. M. Price discussed at some length the matter of economics referred to by the speaker.

April 16, 1924: Theodore W. Richards, Ph.D., Sc.D., M.D., LL.D., Director, Wolcott Gibbs Memorial Laboratory, Harvard University, Cambridge, Massachusetts, presented a paper on "Compressibility, Internal Pressure and Atomic Magnitudes," in which he pointed out that the changes of volume suffered by liquids and solids during physico-chemical reaction are shown to bear systematic relation to the chemical affinity and cohesion brought into play. Greater affinity accompanies smaller volume, and the greater the contraction the greater the compressibility of the substances concerned. Hence it is inferred that chemical and cohesive affinity exert pressure which tends to diminish the volume of the reacting systems. Apparent exceptions, on suitable interpretation, really support the rule. From recent determinations of compressibility by the speaker and by Prof. P. W. Bridgman at Harvard, mathematical inferences were drawn as to the magnitude of the pressures thus produced. Moreover, since the changes of volume must be referred ultimately to the spaces occupied by atoms in solids and liquids, these considerations make it possible to compute (with a minimum of hypothetical speculation) the actual magnitudes of the bulks of individual atoms. Doctor Richards endeavored to present the salient features of this train of thought in such manner as to be

comprehensible to those not conversant with the matter. His communication, which was illustrated by lantern slides, was published in the July, 1924, issue of the JOURNAL. At this meeting Honorary Membership was conferred on Dr. Charles A. Coffin, who was presented by Dr. Samuel Insull, a Life Member of the Institute.

May 21, 1924: Mr. W. C. L. Eglin, President, in the chair, recognized Dr. Joseph S. Ames, Dean, The Johns Hopkins University, Baltimore, Maryland, who made a statement relative to the work of Sir Ernest Rutherford, F.R.S., Cavendish Professor of Physics, Cambridge University, Cambridge, England, recently awarded the Franklin Medal in recognition of "long-continued and fruitful researches, signally contributing to the present state of knowledge of the elements, their constitution and relationships." H. G. Chilton, Esquire, C.M.G., Counsellor of the British Embassy, Washington, D. C., representing His Britannic Majesty's Government, was then presented to the Chairman and received from him the Franklin Medal, accompanying Certificate, and Certificate of Honorary Membership in the Institute, awarded to Sir Ernest Rutherford. Mr. Chilton expressed for his Government its appreciation of the high honor conferred upon his distinguished countryman. Dr. Frank Sprague, of New York City, was then recognized, and described the work of Dr. Edward Weston, of Newark, New Jersey, who had been awarded the Franklin Medal in recognition of "discoveries and inventions in the field of electricity immeasurably fruitful and fundamentally contributory to the establishment of the electric art." Due to the illness of Doctor Weston, Dr. L. H. Baekeland, President of the American Chemical Society, was presented to the Chairman and received from him the Franklin Medal, accompanying Certificate, and Certificate of Honorary Membership in the Institute for Doctor Weston. The paper, "Early Days in Radio-activity," prepared for presentation at this meeting by Sir Ernest Rutherford, was read by Dr. Joseph S. Ames, and has since been published in the September, 1924, issue of the JOURNAL.

At these Stated Meetings of the Institute there was a total attendance of 1053.

Sixteen other meetings were held during the year in the hall of the Institute. The following is a list of dates and speakers with titles and synopses of their communications:

October 25, 1923: John A. Miller, Ph.D., Professor of Mathematics and Astronomy, Swarthmore College, Swarthmore, Pennsylvania, presented a paper on "Solar Eclipse of 1923," giving a general statement of the problems attacked during the eclipse: the study of the form of the corona; a study of the chemical composition of the corona; a study of the motion of the corona; and the testing of the Einstein theory. He described the instruments used for the various problems, and spoke of the Swarthmore program of observations at Yerbanis, Mexico. The paper was illustrated by lantern slides.

November 1, 1923: Howard T. Barnes, D.Sc., F.R.S., Former Professor of Physics, McGill University, Montreal, Canada, presented a communication on "Ice Formation," calling attention to the delicate poising of the forces of Nature as illustrated by the freezing of water in lakes and rivers. He contrasted the melting temperature of ice with the freezing temperature of water, and spoke of surface ice, its rate of growth as influenced by atmospheric

conditions, its crystalline structure and the conditions which determine its non-formation. He described ice formed in running water, such as needle or frazil ice; and ice formed on the bottom of a river, such as ground or anchor ice; and told of water powers developed with ice troubles reduced to a minimum, describing methods in use for the continuous operation of a power house. There were lantern slides to illustrate the paper.

November 8, 1923: W. T. Bovie, Ph.D., Collis P. Huntington Memorial Hospital, Harvard Medical School, Boston, Massachusetts, presented a paper on "Electromechanics of Cell Growth." This paper, which was illustrated by lantern slides, discussed the sub-microscopic organization of protoplasm and the rôle of the electrical and molecular phenomena of the colloid interfaces in cell growth.

November 15, 1923: F. W. Peek, Jr., A.B., M.E.E., Consulting and Research Engineer, General Electric Company, Pittsfield, Massachusetts, read a paper on "High Voltage Phenomena." After a short review of the effects of the various types of high voltage, such as direct current, alternating current, high frequency and lightning, the speaker discussed his recent researches at one to two million volts. In this work both 60-cycle alternating and lightning voltages were used. He showed that aside from its fundamental and theoretical importance in the determination of physical laws, this research has a practical value in power transmission as well as in the protection of transmission lines and buildings from lightning. The paper, which appeared in the January, 1924, issue of the *JOURNAL*, was not technical, and many interesting phenomena were illustrated by lantern slides and motion pictures.

December 6, 1923: Frederick E. Wright, Ph.D., Geophysical Laboratory, Carnegie Institution of Washington, Washington, D. C., spoke on "South African Geological Problems and Their Laboratory Study," illustrating his talk with lantern slides and experiments. He said that geology is concerned primarily with the history of the earth as it is written in the rocks exposed at the surface. These rocks were formed at different times and under different sets of conditions, many of which are not accessible to the geologist, who in turn uses his imagination to visualize the conditions which could have produced the effects he observes. The imagination may be aided, and definite limits set beyond which it may not safely venture, by properly conducted experiments on materials similar in character to those which constitute the rocks. These experiments are not limited to the laboratory, for we have experiments going on both indoors and outdoors and may consider processes in nature as experiments, some of them on a prodigious scale, which we can study with the aid of proper measuring apparatus. South Africa affords excellent opportunities for geological studies on problems of this kind which require for their solution both field and laboratory work. In this paper an outline was given of the results obtained by a combination of field and laboratory studies on certain geological problems during a recent visit to South Africa.

December 13, 1923: Henry Leffmann, A.M., M.D., Philadelphia College of Pharmacy and Science, Philadelphia, Pennsylvania, presented a communication, illustrated by lantern slides and experiments, on "Hydrogen Ion Concentration in Relation to Animal and Plant Growth." Doctor Leffmann said that the titration of a solution with the aid of indicators gives the total acidity

or alkalinity, but does not give the amount of active hydrogen or hydroxyl developed by the ionizing action of the solvent. He said that this fact does not interfere in the ordinary operations of the laboratory, but in studies of the action of liquids upon living tissues, the amount of acid or alkali ionized is of great importance. The problems of determining the degree of ionization and interpreting the results have been extensively studied. The earlier views of the nature and constitution of acids and alkalies were briefly summarized, after which were set forth some of the salient features of the modern investigations into the relation of ionization to the physiological processes of plants and animals. The paper appeared in the June, 1924, issue of the *JOURNAL*.

January 10, 1924: L. B. Tuckerman, A.B., Bureau of Standards, Department of Commerce, Washington, D. C., presented a paper on "Materials and Structural Testing," in which he discussed the function of the materials and structural testing laboratory in the development of structural engineering. The paper, which was illustrated by lantern slides, dealt with the following topics:

1. Tests of materials and their significance in determining the value of materials in use.

2. The problem of new materials.

3. Structural testing.

- Full scale tests.

- Model tests.

- Optical stress analysis.

4. Service tests.

5. Correlation of the results of materials, structural and service tests.

January 24, 1924: L. T. Troland, Ph.D., Professor of Psychology, Harvard University, Cambridge, Massachusetts, spoke on "The Interrelations of Modern Physics and Modern Psychology." The paper, which was illustrated by lantern slides, was later published in the April, 1924, issue of the *JOURNAL*. Doctor Troland said that the psychological sciences have in general been delegated to deal with those facts of experience which are not considered by the physical sciences. Thus the very conception of the psychical depends reciprocally upon that of the physical, and must change with the latter. He discussed the present status of this relationship in the light of modern physical ideas. Another phase of the topic consists in the relations which are found experimentally to exist between psychological and physical phenomena, and the speaker discussed some specific modern problems in this field with the purpose of making clear the general nature of the psychophysical relationship—the interdependency of "body and mind"—as it must be formulated in terms of the latest conceptions of physics. Finally, he gave brief consideration to the more philosophical problem as to the manner in which the interrelationships of physical and psychical are to be explained.

January 31, 1924: Wheeler P. Davey, Ph.D., Research Laboratory, General Electric Company, Schenectady, New York, presented a paper on "Radiation" since published in the April and May issues of the *JOURNAL*. Since those radiations which are commonly called "wave motions" cannot be affected while traversing empty space, our whole knowledge of them is based on experiments which deal (a) with the material substances in the source of the "waves," or (b) with the material substances which may be interposed in

their path. For this reason the study of these radiations really consists in a study of the nature of matter and electricity. Many branches of physics and chemistry contribute to this study. The purpose of Doctor Davey's paper, which was illustrated by lantern slides, was to show what these contributions are and how they are related to the general problem of radiation.

February 7, 1924: O. B. Blackwell, Transmission Development Engineer of the American Telephone and Telegraph Company, New York City, New York, presented a communication illustrated by lantern slides on "The Guiding Wire in Electromagnetic Transmission." Mr. Blackwell showed that electric power and communication systems are made possible by the fact that energy in the form of electromagnetic waves may be guided by conducting wires. He discussed this fundamental fact and gave a general picture of electromagnetic transmission of energy, showing how the energy is transmitted through the space outside the wires, and how the wires restrict the outward spreading of the energy and guide it along its route. He included some discussion as to what takes place in starting electromagnetic waves and receiving them at the distant end of a circuit, and at points of discontinuity along the route; and followed this by a general picture of the network of wires extending over the United States, particularly those for communication purposes. He also considered some of the problems which have arisen in setting up, maintaining and operating the electrical network for telephone communication.

February 14, 1924: Paul D. Foote, Ph.D., Physicist, Bureau of Standards, Department of Commerce, Washington, D. C., presented a paper on "Spectroscopy and Atomic Structure," which was illustrated by lantern slides, and has since appeared in the *JOURNALS* for September and October, 1924. An atom consists of a highly concentrated mass of positive electricity of total charge Ze , surrounded by Z planetary electrons each with the negative charge e , where Z is the atomic number of the element. From a vast accumulation of experiments on spectra, X-rays and critical potentials, we find that the atoms of a given species are capable of existing in a series of states characterized by discreet energy values. Furthermore, all of these atoms which possess a given energy behave similarly in every respect, regardless of their past history. This is an astounding conclusion. Why should the planetary systems of all sodium atoms, for example, be exactly similar, when we know that every type of Keplerian motion and configuration is possible in an astronomical system, depending upon the physical conditions at the time the universe was created? The experimental facts have led to the Quantum Theory of Atomic Structure. Here we are concerned with the most difficult celestial mechanics—for uranium a problem of 93 bodies. Fortunately, Nature has solved these problems which are impossible for the mathematician. The solution is in the form of spectral series and groups of spectroscopic lines. The physicist needs only to interpret the meaning of such cryptograms, and greater progress has been made in this task during the past two years than in the preceding century. Doctor Foote in his paper reviewed these recent developments and the attempts to relate the spectra of the various elements to the motions of the planetary electrons.

February 28, 1924: L. W. McKeehan, Ph.D., Research Laboratories of the American Telephone and Telegraph Company and Western Electric Com-

pany, Incorporated, New York City, spoke on "Ferromagnetism and Its Dependence upon Chemical, Mechanical and Thermal Conditions." He showed how recent theoretical and experimental studies upon the magnetic properties of atoms and ions in gases and liquids have emphasized the need for more searching study into the ferromagnetic condition of atoms in solid metals and alloys, and how improvements in ferromagnetic materials for particular purposes have supplied opportunities for such study. New instruments of research have been devised for the examination of samples subjected to mechanical and thermal control prior to or during the observations. Doctor McKeehan also said that simultaneous variations of other than magnetic properties afford clues to the nature of the atomic or sub-atomic processes in magnetization. His paper, which was illustrated by lantern slides, has since appeared in the May and June, 1924, issues of the JOURNAL.

March 6, 1924: O. Maass, Ph.D., Professor of Physical Chemistry, McGill University, Montreal, P. Q., Canada, presented a paper illustrated by lantern slides on "Molecular Attraction and Molecular Combination." He said that the experimental determination of physical properties, such as gas density, melting point, surface tension, etc., has given an insight into the relative magnitudes of attractions existing between molecules; and that the actual isolation of molecular compounds and the measurement of the rates of chemical reactions are also available for investigation of molecular attraction. The constituents of oxonium compounds and the unsaturated hydrocarbons in conjunction with the halogen hydrides have been used for an investigation of this kind, and Doctor Maass discussed the results in connection with prevailing views of electron distribution in molecules. This paper appeared in the August, 1924, issue of the JOURNAL.

March 13, 1924: Charles H. Paul, C.E., Chief Engineer, The Miami Conservancy District, Dayton, Ohio, at a joint meeting with the Philadelphia Section, American Society of Civil Engineers, presented a communication on "Control of River Flood Conditions with Special Reference to the Miami Conservancy District of Ohio." He discussed the problems involved in the control of river floods, and described some methods used in this country and abroad, giving a detailed explanation of the causes and effects of the 1913 flood in the Miami Valley. He showed the manner in which data were collected and studies made preliminary to design, and followed this by an outline of the design and structures of the Miami Conservancy District and the manner in which they were constructed. These works include five large earth dams constructed by the hydraulic method, and a series of river channel and levee improvements in each of the cities of the district. The paper was illustrated by lantern slides, and appeared in the August, 1924, issue of the JOURNAL.

March 27, 1924: John Johnston, D.Sc., Sterling Professor of Chemistry, Yale University, New Haven, Connecticut, spoke on "Solubility Relations of Organic Compounds." The paper, which was illustrated by lantern slides, showed that systematic investigation of solubility of organic compounds, and in particular of isomeric and other closely related substances, is yielding results of considerable significance. In the first place, it offers a means of analyzing mixtures of isomeric substances which are not separable by purely chemical

methods; which is of importance because one must have a method of analysis before proceeding to ascertain how variation of conditions favors the formation of one substance or another—a matter of great interest industrially. In the second place, it will enable us accurately to predict the solubility relations in many systems, and, by reason of the gradations which can be secured in both solute and solvent, it promises information as to the factors which determine solubility.

April 3, 1924: Allston Dana, A.B., B.S., Assistant Engineer of Design, Delaware River Bridge Joint Commission, and Montgomery B. Case, B.Sc., Senior Resident Engineer, Delaware River Bridge Joint Commission, spoke on "The Anchorages of the Bridge Over the Delaware River Between Philadelphia and Camden." Mr. Dana discussing the design, and Mr. Case the construction, both communications being illustrated by lantern slides. Mr. Dana described the huge masonry structures which hold the ends of the bridge cables and withstand their pull, and of the foundations which carry this pull and the entire weight of the anchorages down to rock, and showed the function of the different parts of the anchorage, including the eyebar chains and anchor girders, the inclined steel towers, the various masses of masonry, and the foundations. He also described the criteria used for strength and stability, and the other considerations which determined the design, including an analysis of the forces and stresses based on the probable elastic behavior of this more or less articulated structure, and the reinforcing of the foundations to withstand stresses encountered during their sinking as open dredge caissons. Mr. Case spoke of the problem of supporting the concrete foundation caissons weighing many thousand tons, in such a way as to avoid deflections until the concrete had hardened, and to insure the safe removal of the support before sinking was started. He described the construction of the caissons in twenty-foot layers as the sinking proceeded; the methods used in sinking by open excavation without air pressure; the preparation of the rock surface; and the sealing of the dredging wells. He also took up the construction of the concrete mass above the ground surface and the placing of the anchor girders with their eyebar chains which lead to the point of attachment for the cable strands, telling of the erection and support of the inclined steel towers over which the cables are deflected down to their anchorage. This was a joint meeting with the Philadelphia Section, American Society of Civil Engineers. The following day an inspection trip was held to visit the bridge anchorages. The papers of both Mr. Dana and Mr. Case were published in the September, 1924, issue of the JOURNAL.

At these meetings there was a total attendance of 1894, the meeting scheduled for April 10, 1924, having been omitted.

Respectfully submitted,

GELLERT ALLEMAN,
Chairman.

PHILADELPHIA, January 14, 1925.

REPORT OF THE COMMITTEE ON ELECTION AND RESIGNATION OF MEMBERS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1924

To the Board of Managers of The Franklin Institute:

During the fiscal year ending September 30, 1924, seventy-four new members were enrolled in all classes of membership; resignations were received and accepted from twenty-nine members; and deaths of twenty-one members were recorded.

The detail as to elections, resignations, and deaths for the two years ending September 30, 1924, is as follows:

| ELECTIONS: | 1922-23 | 1923-24 |
|---------------------------------------|-----------|-----------|
| Resident Members | 32 | 37 |
| Non-Resident Members | 21 | 33 |
| Associate Members | 4 | 3 |
| Honorary Members | 0 | 0 |
| Corresponding Members | 0 | 0 |
| Life Members | 2 | 1 |
| Second Class Stock | 1 | 0 |
| | <u>60</u> | <u>74</u> |
| RESIGNATIONS: | | |
| Resident Members | 9 | 13 |
| Non-Resident Members | 18 | 15 |
| Associate Members | 3 | 1 |
| Second Class Stock | 0 | 0 |
| | <u>30</u> | <u>29</u> |
| DEATHS: | | |
| Resident Members | 11 | 8 |
| Non-Resident Members | 10 | 7 |
| Life Members | 3 | 4 |
| Honorary Members | 1 | 1 |
| Associate Members | 1 | 0 |
| Second Class Stock | 1 | 0 |
| Corresponding Members | 0 | 1 |
| | <u>27</u> | <u>21</u> |
| SUMMARY: | | |
| Elections | 64 | 74 |
| Resignations | 30 | 29 |
| Dropped for non-payment of dues | 23 | 15 |
| Deaths | 27 | 21 |
| Net increase in membership | | 27 |

Membership of the Institute by Classes, September 30, 1924.

| | |
|----------------------------------|-------------|
| Resident Members | 538 |
| Non-Resident Members | 563 |
| Life Members | 199 |
| Honorary Members | 24 |
| Associate Members | 28 |
| Second Class Stock Members | 24 |
| Corresponding Members | 2 |
| Total | <u>1378</u> |

An increase of twenty-seven was recorded in the membership of the Institute for the year ending September 30, 1924.

Respectfully submitted,

R. W. LESLEY,
Chairman.

PHILADELPHIA, January 14, 1925.

REPORT OF THE COMMITTEE ON STOCKS AND FINANCE

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1924

To the Board of Managers of The Franklin Institute:

The Committee presents the following statement:

PROPERTY AND FUNDS

| | | |
|---|-------------|--------------|
| Building and Land, 13-17 South Seventh Street.... | \$60,000.00 | |
| Library | 100,000.00 | \$160,000.00 |

| | <i>Principal</i> | <i>Unexpended Income</i> | |
|---|-----------------------|------------------------------|-----------------------|
| Funds held by Board of Trustees | \$623,027.88 | \$2,537.48 | |
| Funds held by Board of Managers.... | 169.44 | | |
| Franklin Institute Building Fund..... | 554,582.60 | | |
| Elliott Cresson Medal Fund..... | 3,000.00 | 1,017.88 | |
| Franklin Fund and Building Committee | 16,826.21 | | |
| Total Funds | <u>\$1,197,606.13</u> | <u>\$3,555.36</u> | \$1,201,161.49 |
| Grand Total | | | <u>\$1,361,161.49</u> |

LIABILITIES

| | |
|-----------------------------|--------------------|
| Certificates of Stock | \$28,804.00 |
| Bills Payable | 33,000.00 |
| Vouchers Payable | 2,762.46 |
| Unearned Income | 67.50 |
| | <u>\$64,633.96</u> |

INCOME AND EXPENSES APPLICABLE TO THE YEAR ENDED SEPTEMBER 30, 1924

Income:

| | | |
|--|------------|-------------|
| Dues—Resident | \$7,470.00 | |
| Non-Resident | 2,735.00 | |
| Second Class Stock..... | 252.00 | |
| Associate | 82.50 | \$10,539.50 |
| Initiation Fees | | 140.00 |
| H. Belfield Memorial Fund | | 268.82 |
| James H. Cresson Memorial Fund | | 2,302.31 |
| General Endowment Fund | | 19,265.23 |
| John H. Wahl Fund | | 4,578.59 |
| Lewis S. Ware Library Fund | | 600.00 |
| Estate of John Turner | | 156.49 |
| Estate of Robert Wright | | 2,144.65 |
| Publications—Subscriptions and Sales | \$3,481.50 | |
| Advertising | 4,413.37 | 7,894.87 |
| “Physics of the Air” | | 250.00 |
| Miscellaneous Income and Expense | | 704.16 |
| Total | | \$48,844.62 |

EXPENSES

| | | |
|--|-------------|------------|
| Building—Wages | \$1,893.85 | |
| Repairs and Maintenance | 2,085.30 | |
| Taxes, Water Rent and Insurance | 96.89 | |
| Heat, Light and Power | 936.22 | |
| Miscellaneous Supplies and Expense | 370.86 | \$5,383.12 |
| Instruction—Salaries and Annuities | \$250.00 | |
| Miscellaneous Expense | 148.92 | 398.92 |
| Library—Salaries | 9,346.95 | |
| Books and Periodicals | 1,673.32 | |
| Binding | 1,150.00 | |
| Miscellaneous Expense | 490.61 | 12,660.88 |
| Meetings | | 1,398.64 |
| Office and General—Salaries | \$14,998.29 | |
| Office Expense | 2,102.62 | |
| General Expense | 1,578.86 | |
| Auditor and Treasurer | 918.87 | 19,598.74 |
| Publications—Printing | \$14,723.07 | |
| Illustrating | 3,259.68 | |
| Miscellaneous Expense | 815.98 | |
| Year Book | 822.01 | |
| Reprints | 1,064.41 | 20,685.15 |

| | |
|-------------------------------|--------------------|
| Science and Arts | 3,868.44 |
| Sections | 1,881.11 |
| Interest and Discount | 1,369.44 |
| Badges and Certificates | 82.58 |
| Total | <u>\$67,327.02</u> |
| Deficit | \$18,482.40 |

Respectfully submitted,

WALTON FORSTALL,
Chairman.

PHILADELPHIA, January 14, 1925.

REPORT OF THE COMMITTEE ON PUBLICATIONS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1924

To the Board of Managers of The Franklin Institute:

The December number of the JOURNAL OF THE FRANKLIN INSTITUTE will complete its one hundred and ninety-eighth volume.

A comparison of this volume with the first furnishes a striking record of the material changes that have taken place since the year of the first publication in 1826. At that time the emphasis was placed upon the material things that could be seen, handled and used in industrial pursuits and the results are seen in the outstanding progress in industrial applications of the past one hundred years. At the present time a determined attack is being made upon the constitution of matter and in order to solve this problem use is made of the most highly specialized forms of scientific apparatus.

In volume one its sixty-four pages treated of such topics as the proposed exhibition of October, 1826, with a list of sixty-one prizes to be awarded for such practical purposes as the best stove or grate for burning anthracite; the best soft iron castings; the best black broadcloths; the best beaver hat, price nine dollars, etc.

The one hundred and fifty-seven pages of the issue for September, 1924, contain such articles as "Early Days in Radio-activity" and "Spectroscopy and Bohr's Theory of Atomic Structure."

During the past year your Committee on Publications has held its usual stated monthly meetings at which the contents of the JOURNAL have been determined.

During the year two hundred and seventy-seven copies of Doctor Humphreys' "Physics of the Air" were sold, leaving on hand two hundred and ninety-six copies.

The articles previously printed in the JOURNAL OF THE FRANKLIN INSTITUTE on "The Electron in Chemistry," by Sir J. J. Thomson, were collected in book form and revised, three thousand copies being printed. Of these two thousand and fifty-nine copies have been sold.

The expenses of the Committee for the year are as follows:

| | |
|-----------------------------|--------------------|
| Printing | \$14,723.07 |
| Illustrations | 3,259.68 |
| Year Book | 822.01 |
| Miscellaneous Expense | 815.98 |
| Total | <u>\$19,620.74</u> |

The net expenses are less than this amount, the receipts being:

| | |
|---------------------------------|--------------------|
| For Advertisements | \$4,413.37 |
| For JOURNAL Subscriptions | <u>3,481.50</u> |
| Total Receipts | \$7,894.87 |
| Making the net cost | <u>\$11,725.87</u> |

Respectfully submitted,

GEORGE D. ROSENGARTEN,

PHILADELPHIA, January 14, 1925.

Chairman.

REPORT OF COMMITTEE ON ENDOWMENT

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1925

To the Board of Managers of The Franklin Institute:

Your Committee has received the two following Endowments this year:

| | |
|--------------------------------------|------------|
| Louis Edward Levy Medal Fund | \$2,500.00 |
| George R. Henderson Medal Fund | 2,500.00 |

Respectfully submitted,

G. H. CLAMER,

PHILADELPHIA, January 14, 1925.

Chairman.

REPORT OF THE COMMITTEE ON SCIENCE AND THE ARTS

FROM OCTOBER 1, 1923, TO JANUARY 31, 1925

To the President and Members of The Franklin Institute:

In order to have the yearly report of the Chairman cover the exact months of his Chairmanship, this report includes a record of the work of the Committee on Science and the Arts, from October 1, 1923, to January 31, 1925. The year 1924 was the ninetieth in which the Committee has rendered service to the Institute. During the period which this report covers, investigation and final disposition of eighteen cases were made, and there are now pending seventeen cases.

The appendix of this report gives the name of the inventor, the name of the invention and the award made in each case.

Eleven of the eighteen cases investigated received awards, one was tabled, one was withdrawn and five were dismissed without prejudice.

The standing Sub-Committee on The Franklin Medal and the standing

Sub-Committee on Literature met as required during the year, and on their recommendation the awards shown in the appended statement were made.

In commemoration of the long and valued service to The Franklin Institute, through its Committee on Science and the Arts, the family of Mr. Louis Edward Levy contributed the sum of two thousand five hundred dollars (\$2,500) to establish a fund to be known as the Louis Edward Levy Medal Fund, from the income of which medals are to be awarded for papers on presentations of original work, published in the Institute's JOURNAL.

The first Levy Medal was awarded to Dr. Harvey Fletcher, of the American Telephone and Telegraph Company of New York, as detailed in the appendix.

Mrs. George R. Henderson, whose husband was an active and interested member of the Committee on Science and the Arts from 1912 until 1921, also contributed the sum of two thousand five hundred dollars (\$2,500) for the establishment of a medal fund in memory of her husband to be known as the George R. Henderson Medal Fund, from the income of which medals are to be given for inventions and improvements in railway engineering.

The Sub-Committee on New Subjects and Preliminary Examination met each month, except July, August and September, and considered fifty-nine subjects. Applications were received covering eleven of these subjects and sub-committees of investigation were appointed. The work of this Sub-Committee is of especial value since by its examinations the Committee is prevented from having unsuitable subjects called to its attention.

Recipients of awards were invited to attend the Stated Meetings of the Institute to receive the awards from the hand of our President, and except in four instances the invitation was accepted.

Two Franklin Medals were presented at the May Meeting of the Institute, one to Sir Ernest Rutherford, of Cambridge, England, and one to Dr. Edward Weston, of Waverly Park, Newark, New Jersey. After a statement by Dr. Joseph S. Ames of the Johns Hopkins University, Baltimore, Maryland, relative to the contributions of Sir Ernest Rutherford to the present state of knowledge of the elements, their constitution and relationships, the medal awarded Sir Ernest was received by Mr. M. G. Chilton, Counsellor of the British Embassy.

After a statement by Dr. Frank J. Sprague, of New York City, N. Y., relative to the work of Doctor Weston in the electric art, the medal was placed in the hands of the Secretary for transmission to Doctor Weston, who was too ill to attend the meeting.

The Committee has suffered serious loss during the past year in the death of four of its active members:

Doctor Harry F. Keller—February 5, 1924.

Mr. Edward V. McCaffrey—June 15, 1924.

Mr. Charles W. Masland—September 15, 1924.

Dr. Roger F. Brunel—December 23, 1924.

In January, 1924, the office of the Committee on Science and the Arts was removed from the Institute on Seventh Street to a room in one of the buildings on Nineteenth Street that have been reconditioned in connection with the work of the Bartol Research Foundation. A meeting room has also been

supplied at the Nineteenth Street buildings provided with a projection lantern. The first meeting held in this room was on February 6, 1924. Dr. Wm. C. L. Eglin was present at this meeting and spoke in words of highest praise of the valuable work done each year by the Committee on Science and the Arts.

On account of the Celebration of the Centenary of the Institute on the 17th, 18th and 19th of September and the necessary work of preparation, the September meeting of the Committee was omitted.

A detailed statement of the Committee's work during the period which this report covers is appended.

Respectfully submitted,

GEO. H. BENZON, JR.,
Chairman.

APPENDIX

STATEMENT OF THE COMMITTEE'S OPERATION FROM OCTOBER 1, 1923, TO JANUARY 31, 1925

| | |
|---|----------|
| Cases pending October 1, 1923 | 18 |
| Applications received to January 31, 1925 | 11 |
| Special Reports | 6 |
| | <hr/> 35 |
| Disposed of to January 31, 1925 | 18 |
| Leaving pending | 17 |

AWARDS MADE

| | |
|--------------------------------|----------|
| Franklin Medal Awards | 2 |
| Louis Edward Levy Awards | 1 |
| Howard N. Potts Awards | 2 |
| Edward Longstreth Awards | 6 |
| | <hr/> 11 |

THE FRANKLIN INSTITUTE AWARDS

OCTOBER 1, 1923, TO JANUARY 31, 1925

THE FRANKLIN MEDAL

TO

Sir Ernest Rutherford, of Cambridge, England, "in recognition of long-continued and fruitful research, signally contributing to the present state of knowledge of the elements, their constitution and relationships."

Doctor Edward Weston, of Waverly Park, Newark, New Jersey, "in recognition of discoveries and inventions in the field of electricity immeasurably fruitful and fundamentally contributory to the establishment of the electric art."

THE LOUIS EDWARD LEVY MEDAL

TO

Harvey Fletcher, of the American Telephone and Telegraph Company, New York, for his paper entitled "Physical Measurements of Audition and Their Bearing on the Theory of Hearing" in the JOURNAL.

THE HOWARD N. POTTS MEDAL

TO

John A. Anderson, of Pasadena, California, for his work in Spectroscopy and his inventions embodied in the Seismograph.

William Gaertner, of Chicago, Illinois, for his Design and Manufacture of Scientific Instruments.

THE EDWARD LONGSTRETH MEDAL

TO

William Swan Elliott, of Pittsburgh, Pennsylvania, for his Process and Apparatus for the Deaeration of Liquids.

Thomas C. McBride, of Philadelphia, Pennsylvania, for his inventions embodied in the Locomotive Feed Water Heater.

Carl P. Nachod, of Louisville, Kentucky, for his inventions embodied in the Nachod Electric Railway Signal System.

Harry S. Parks, of Philadelphia, Pennsylvania, for his inventions embodied in the Pneumercator Tank and Draft Gauge.

Milton Roy Sheen, of Philadelphia, Pennsylvania, for his inventions embodied in the Expansion Machine for Tunnel Construction.

William R. Zimmermann, of Newark, New Jersey, for his inventions embodied in the Hob for Worm Gears.

AWARDS

1835-1925

FRANKLIN MEDAL AWARDS

1915-1925

ARRHENIUS, SVANTE AUGUST, PH.D., M.D., D.Sc., LL.D.

"In recognition of his notable contributions to the theory of physical science which have found unprecedently extended and fruitful application in the experimental study of chemical, physical, biological and cosmic phenomena, as well as in industrial chemistry."

1920.

CARTY, JOHN J., D.ENG., D.Sc., LL.D., D.S.M.

"In recognition of his long-continued activities in the telephone service, his important and varied contributions to the telephone art, his work in the establishment of the principles of telephone engineering, and his signal success in directing the efforts of a large staff of engineers and scientists to the accomplishment of the telephonic transmission of speech over vast distances."

1916.

DEWAR, SIR JAMES, LL.D., D.Sc., PH.D., F.R.S.E., F.I.C., F.C.S.

"In recognition of his numerous and most important contributions to our knowledge of physical and chemical phenomena and his great skill and inventive genius in attacking and solving chemical and physical problems of the first magnitude."

1919.

EDISON, THOMAS ALVA, PH.D., D.Sc., LL.D.

"In recognition of the value of numerous basic inventions and discoveries forming the foundation of world-wide industries, signally contributing to the well-being, comfort and pleasure of the human race."

1915.

FABRY, CHARLES, D.Sc.

"In recognition of his numerous and highly important contributions in the field of physical science, particularly the solution of optical and spectroscopical problems of fundamental importance."

1921.

FERRIÉ, AUGUSTE GUSTAVE, GENERAL

"In recognition of his long-continued and successful researches in the field of radio-transmission of intelligence and their splendid and successful military applications, and of his eminent success in the organization

FRANKLIN MEDAL AWARDS

and directing of the communication service of the French Army during the World War."
1923.

LORENTZ, HENDRICK ANTOON, PH.D., F.R.S.

"In recognition of his researches which have so largely contributed to laying on a new foundation our knowledge of the nature of light and in developing our ideas concerning the ultimate construction of matter."
1917.

MARCONI, GUGLIELMO, LL.D., D.Sc.

"In recognition of his brilliant inception and successful development of the application of magneto-electric waves to the transmission of signals and telegrams without the use of metallic conductors."
1918.

MENDENHALL, THOMAS CORWIN, PH.D., D.Sc., LL.D., F.A.G.S.

"In recognition of his fruitful and indefatigable labors in physical research, particularly his contributions to our knowledge of physical constants and electrical standards."
1918.

MICHELSON, ALBERT A., PH.D., Sc.D., LL.D.

"In recognition of his numerous and signally fruitful researches in physical science, especially his brilliant discoveries in the fields of optics and astrophysics."
1923.

MODJESKI, RALPH, D.ENG.

"In recognition of his signal achievements as a designer and a builder of structures, mainly bridges, many of them epoch-marking in the history of the engineering profession, beautiful as well as useful, involving on the part of the designer, vision, courage and technique of the highest order."
1922.

ONNES, HEIKE KAMERLINGH, PH.D., D.Sc.

"In recognition of his long-continued and indefatigable labors in low-temperature research, which have enriched physical science, not only with a great number of new methods and ingenious devices, but also with achievements and discoveries of the first magnitude."
1915.

PARSONS, SIR CHARLES ALGERNON, K.C.B., C.B., M.A., LL.D., D.Sc., F.R.S.

"In recognition of his epoch-marking success in the development of the steam turbine, which has revolutionized the art of steam engineering, particularly in regard to the propulsion of mercantile and naval vessels and the driving of electrical generators."
1920.

CRESSON MEDAL AWARDS

1856-1925

ACKER, C. E.

Process of Manufacturing Caustic, etc.—1902.

ALBERT, CHARLES F.

Violins and Bows.—1887.

AMERICAN COTTON COMPANY.

Round Lap Bale System.—1901.

AMERICAN PAPER BOTTLE COMPANY.

Paper Bottles for Various Purposes.—1906.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY.

Contributions to the Modern Telephone Art.—1916.

ATWATER, W. O., and ROSA, E. B.

Respiration Calorimeter.—1900.

AUTOMATIC ELECTRIC COMPANY.

Automatic Telephony.—1910.

BAEYER, J. F. A. VON.

Research Work in Organic Chemistry.—1912.

BALDWIN LOCOMOTIVE WORKS.

Contributions to the Evolution of the American Locomotive.—1907.

BATCHELLER, C. H.

Compound Locomotive.—1893.

BATES, STOCKTON; SHAW, EDWIN, and VON CULIN, G. M.

Spindle Support.—1891.

BELL, ALEXANDER GRAHAM.

Electrical Transmission of Speech.—1912.

BERLINER, EMILE.

Telephony and Sound Reproduction.—1913.

BEVINGTON, J. H.

Welding Metal and Spinning and Shaping Tools.—1891.

BILGRAM, HUGO.

Bevel Gear Cutter.—1887.

BONWILL, W. G. A.

Electro-Magnetic Dental Mallet.—1876.

BORSCH, LOUIS.

Solid Invisible Bifocal Lens.—1907.

BOWER, HENRY.

Inodorous Glycerine.—1878.

BRASHEAR, JOHN A.

Leading Work in Astronomic Science.—1910.

CASTNER, H. Y.

Electrolytic Process of Decomposing Alkaline Chlorides for the Production of Caustic and Chlorine.—1897.

CHABOT, CYPRIEN.

Shoe Sewing Machine.—1885.

CHEMISTS MEDAL AWARDS

CHEMISTS MEDAL AWARDS.

Edin and Kover Copper.—1878.

CHESBROUGH, J.

Steel Corrugating.—1876.

CLARK, C. H.

Methods of Eliminating Metals from Mixture of Metals.—1904.

CORRIGAN, P.

Mercury Rectifier.—1910.

CORSEMAN, T.

All-Wrought Steel Belt Pulley.—1898.

COWLES, FUGENE H., AND ALFRED H.

Electric Smelting Furnace.—1887.

COWPER, EDWARD A., AND ROBERTSON, T. HART.

Writing Telegraph.—1889.

CRUIKSHANK, SIR WILLIAM.

Discoveries in Chemistry.—1912.

CURIE, PIERRE AND MARIE.

Researches Resulting in the Discovery of Radium.—1909.

DEFORREST, LEE.

The Audion.—1922.

DELANITSHEK, NORBERT.

Machine for Treating Flax.—1879.

DELANEY, P. B.

Synchronous Multiplex Telegraphy.—1886.

DELANEY, P. B.

System of Machine Telegraphy.—1896.

DELANEY, P. B.

Telepost.—1908.

DIESEL, R.

Diesel Motor.—1901.

DODGE, J. M.

System of Storing Coal.—1904.

DUDLEY, P. H.

Dynamograph.—1877.

EDER, J. MARIA.

Researches in Photochemistry.—1914.

ELDRICK, BYRON E.

Low Expansion Leading-in Wire for Incandescent Electric Lamps.—1921.

EMMET, WILLIAM LEROY.

Work on Electrical Propulsion of Ships and Prime Movers.—1920.

FERRILL, J. L.

Process of Fireproofing Wood.—1903.

FISCHER, EMIL.

Contributions to Organic Chemistry.—1913.

CRESSON MEDAL AWARDS

- FISKE, B. A.
Range Finder.—1892.
- FISS, BARNES, ERBEN & Co.
Worsted Yarns.—1875.
- FORBES, JOHN S., AND WATERHOUSE, A. G.
Art of Automatically Heating and Sterilizing Fluids.—1901.
- FRITZ, JOHN.
Advancement of Steel Industries.—1910.
- GAEDE, W.
Molecular Air Pump.—1909.
- GANS, ROBERT.
Permutit.—1916.
- GAYLEY, J.
Dry Air Blast in Blast Furnace Operation.—1909.
- GILL, W. L.
School City.—1903.
- GOLDSCHMIDT, HANS.
Alumino-thermics.—1904.
- GOLDSCHMIDT, V.
New Theory of Musical Harmony.—1903.
- GRAY, E.
Telautograph.—1897.
- GRAY NATIONAL TELAUTOGRAPH COMPANY.
Telautograph.—1912.
- GRISCOM, W. WOODNUT.
Electric Motor and Battery.—1881.
- HADFIELD, SIR ROBERT A.
Advancement of Metallurgical Science.—1910.
- HAMMER, W. J.
Historic Collection of Incandescent Electric Lamps.—1906.
- HAMMOND, J.
Typewriter.—1890.
- HAUPT, L. M.
Reaction Breakwater.—1901.
- HAYES, MAYER AND COMPANY.
Manufacture of Files.—1890.
- HEANY, J. ALLEN.
Fireproof Insulated Wire.—1907.
- HERSCHEL, CLEMENS.
Venturi Meter.—1898.
- HOLLERITH, H.
Electric Tabulating Device.—1890.
- HOLMES, P. H.
Lubricant Bearing.—1892.

CRESSON MEDAL AWARDS

HOUGH, R. B.

Contributions to the Characteristics and Uses of the American Woods.—1908.

HOWE, H. M.

Experimental Research on Steel.—1895.

HOWE, H. M.

Metallurgy of Steel.—1892.

IVES, FREDERICK E.

Color Photography.—1893.

JENKINS, C. FRANCIS.

"Phantoscope."—1898.

JOHNSON, RAYMOND D.

Hydraulic Valve.—1923.

KINGSBURY, ALBERT.

Thrust Bearing.—1923.

LANSTON, T.

Monotype Machine.—1896.

LEVY, L. E.

Acid Blast Method and Apparatus for Etching Metal Plates.—1900.

LEVY, L. E.

Machine for Powdering Plates for Etching.—1904.

LEWIS, COL. ISAAC NEWTON.

Machine Gun.—1918.

LINDE, KARL P. G.

Refrigeration Processes.—1914.

LOWE, THADDEUS S. C.

Water Gas Process and Apparatus.—1886.

LOVEKIN, L. D.

Expanding and Flanging Machinery and Tools for all Classes of Tubes.—1904.

LUMIÈRE, AUGUSTE AND LOUIS.

Color Photography.—1909.

MALLET, A.

Articulated Compound Locomotive.—1908.

MARKS, G. E.

Improvements in Artificial Limbs.—1893.

MASON AND HAMLIN COMPANY.

Liszt Organ.—1901.

MERGENTHALER, O.

Linotype.—1889.

MICHELSSEN, A. A.

Work in Physical Optics.—1912.

CRESSON MEDAL AWARDS

- MOISSAN, HENRI.
Investigations with the Electric Furnace.—1898.
- MORLEY, E. W.
Determination of Fundamental Magnitudes in Chemistry.—1912.
- NOBLE, ALFRED.
Achievements in Civil Engineering.—1912.
- NORTHRUP, EDWIN F.
Electric Furnace and High Temperature Investigations.—1917.
- OLSEN, TINIUS.
Testing Machine.—1891.
- OTT AND BREWER.
China and Porcelain Wares.—1886.
- OUTERBRIDGE, A. E., JR.
Molecular Structure of Cast Iron.—1904.
- OWENS, MICHAEL J.
Bottle Blowing Machine.—1915.
- PARKER, J. C.
Steam Generator.—1902.
- PECKOVER, J.
Stone Sawing Machine.—1895.
- PELTON, LESTER A.
Water Wheel.—1894.
- PENCOYD IRON WORKS.
Bridge Construction.—1900.
- PHILLIPS, F.
Pressed Steel Pulley for Power Transmission.—1907.
- POWERS AND WEIGHTMAN.
Exhibit at The Franklin Institute Exhibition of 1874.—1875.
- PRATT AND WHITNEY COMPANY.
System of Interchangeable Cut Gears.—1886.
- PUPIN, M. I.
Art of Reducing Attenuation of Electrical Waves and Apparatus.—1905.
- RAMSAY, R. H.
Railway Car Transfer Apparatus.—1886.
- RAMSAY, SIR WILLIAM.
Discoveries in Chemistry.—1913.
- RANDOLPH, ISHAM.
Achievements in Civil Engineering.—1913.
- RAYLEIGH, LORD.
Researches in Physical Science.—1913.
- ROBERTSON, T. HART AND COWPER, ED. A.
Writing Telegraph.—1889.
- ROENTGEN, W. C.
Investigations of a New Kind of Ray.—1897.

POTTS MEDAL AWARDS

U. S. GEOLOGICAL SURVEY.

Exhibit of Survey.—1900.

UNDERWOOD TYPEWRITER COMPANY.

Typewriter.—1909.

VAUCLAIN, S. M.

Compound Locomotive.—1891.

VERNAZ, ALEXIS.

Milling Files.—1909.

VON CULIN, G. M.; BATES, STOCKTON; SHAW, E.

Spindle Support.—1891.

WALKUP, L.

Air Brush.—1886.

WATERHOUSE, A. G., AND FORBES, JOHN S.

Art of Automatically Heating and Sterilizing Fluids.—1901.

WELSBACH, CARL AUER VON.

Incandescent Mantles.—1901.

WESTON, EDWARD.

Leading Work in Electrical Discovery and Application.—1910.

WHITE, MAUNSEL, AND TAYLOR, FREDERICK W.

Process of Treating Tool Steel.—1902.

WILCKES, J.

"Econometer."—1898.

WILEY, HARVEY W.

Leading Work in Agricultural Chemistry.—1910.

WOOD, H. A. WISE.

Autoplate Machine.—1909.

WRIGHT, ORVILLE.

Work in Aviation.—1914.

YANKO, PAUL VON.

Piano Keyboard.—1893.

ZENTMAYER, JOSEPH.

Microscopes and Objectives.—1875.

POTTS MEDAL AWARDS

1911-1925

ANDERSON, JOHN A.

Work in Spectroscopy and his Seismograph.—1924.

BARKER, WENDELL A.

Wrenchless Chuck.—1920.

BIZZELL, JAMES A., AND LYON, T. L.

"Plants and Relation to Nitrate in Soils" (Paper).—1912.

POTTS MEDAL AWARDS

BONE, WILLIAM A.

"Surface Combustion" (Paper).—1913.

BULLARD, EDWARD P., JR.

Mult-Au-Matic Machine Tool.—1920.

COBLENTZ, W. W.

"Reflecting Power of Metals" (Paper).—1911.

COKER, E. G.

Method of Determining Stress by Photo-Elastic Means.—1922.

DAHLGREN, ULRIC.

"The Production of Light by Animals" (Paper).—1917.

DOWNS, CHARLES RAYMOND, AND WEISS, JOHN MORRIS.

Vapor Phase Oxidation of Benzene to Maleic Acid.—1922.

GAERTNER, WILLIAM.

Design and Manufacture of Scientific Instruments.—1923.

GRAY, ALEXANDER.

"Modern Dynamo Electric Machinery" (Paper).—1918.

HULL, ALBERT W.

"The Crystal Structure of the Common Elements" (Paper).—1923.

HUMPHREYS, WILLIAM J.

"The Thunderstorm and Its Phenomena" (Paper).—1915.

JANNEY, REYNOLD, AND WILLIAMS, HARVEY D.

Hydraulic Speed Gear.—1919.

KENNELLY, A. E.

Linear Hot-Wire Anemometer.—1918.

KING, LOUIS V.

Improvements in Linear Hot-Wire Anemometers.—1918.

LANDRETH, CLARENCE P.

Direct Oxidation Process.—1919.

LYON, T. L., AND BIZZELL, JAMES A.

"Plants and Relation to Nitrate in Soils" (Paper).—1912.

MCCOLLUM, E. V.

"Nutrition and Physical Efficiency" (Paper).—1921.

MODJESKI, RALPH.

"Design of Large Bridges with Special Reference to Quebec Bridge" (Paper).—1914.

MOORE, RICHARD B.

"Helium, its History, Properties and Commercial Development" (Paper).—1922.

LEVY AND LONGSTRETH MEDAL AWARDS

MURRAY, W. S.

"Conditions Affecting the Success of Main Line Electrification" (Paper).
—1916.

TATE, ALFRED O.

Electrolytic Waterproofing of Textile Fabrics.—1921.

WEISS, JOHN MORRIS, AND DOWNS, CHARLES RAYMOND.

Vapor Phase Oxidation of Benzene to Maleic Acid.—1922.

WILLIAMS, HARVEY D., AND JANNEY, REYNOLD.

Hydraulic Speed Gear.—1919.

LEVY MEDAL AWARDS

1924-1925

FLETCHER, HARVEY.

"Physical Measurements of Audition and Their Bearing on the Theory of Hearing" (Paper).—1924.

HAYES, HARVEY C.

"Measuring Ocean Depths by Acoustical Methods" (Paper).—1925.

LONGSTRETH MEDAL AWARDS

1890-1925

ABBE, C.

"Meteorology" (Paper).—1913.

ABBOTT, ROBERT R.

"Modern Steels and Their Heat Treatment" (Paper).—1916.

ACHARD, F. H., KENNELLY, A. E., AND DANA, A. S.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—
1917.

ADAMS, L. H., AND WILLIAMSON, E. D.

"The Annealing of Glass" (Paper).—1921.

ADAMS, W. G., AND FORBES, J. S.

Stop Valve for Radiators.—1893.

ALEXANDER, JOHN E.

"Phonosphere."—1905.

ALTENDER, THEODORE AND SONS.

Drawing Pen.—1905.

ARMSTRONG, WM. T., AND COX, JACOB D.

Grip Socket.—1896.

ARNOLD, B. J.

Magnetic Clutches and System of Electric Power Station Construction.—
1903.

AUSTIN, JOHN T.

Austin Organ.—1917.

FRANKLIN MEDAL AWARDS

RICHARDS, THEODORE WM., A.M., PH.D., Sc.D., LL.D., CHEM.D., M.D., F.C.S.

"In recognition of his numerous and important contributions to inorganic, physical and theoretical chemistry, and particularly his classical series of redeterminations of the atomic weights of the more important chemical elements."

1916.

RUTHERFORD, SIR ERNEST, KT., D.Sc., LL.D., PH.D., D.PHYS., F.R.S.

"In recognition of long-continued and fruitful researches, signally contributing to the present state of knowledge of the elements, their constitution and relationships."

1924.

SPRAGUE, FRANK J., D.ENG.

"In recognition of his many and fundamentally important inventions and achievements in the field of electrical engineering, notably his contributions to the development of the electric motor and its application to industrial purposes, and in the art of electric traction, signally important in forming the basis of world-wide industries and promoting human welfare."

1921.

SQUIER, GEORGE OWEN, K.C.M.G., D.S.M., PH.D.

"In recognition of his valuable contributions to physical science, his important and varied inventions in multiplex telephony and telegraphy and in ocean cabling and his eminent success in organizing and directing the air and signal services of the U. S. Army in the World War."

1919.

TAYLOR, DAVID WATSON, D.ENG., D.S.M.

"In recognition of his fundamental contributions to the theory of ship resistance and screw propulsion and of his signal success in the application of correct theory to the practical design of varied type of war vessels in the United States Navy."

1917.

THOMSON, SIR JOSEPH JOHN, O.M., F.R.S., D.Sc., F.R.S.E., LL.D., PH.D.

"In recognition of the immeasurable service he has rendered to the world as teacher and leader of thought in that domain of science, especially related to a fundamental knowledge of electricity and the constitution of matter."

1922.

WESTON, EDWARD, LL.D., Sc.D.

"In recognition of discoveries and inventions in the field of electricity, immeasurably fruitful and fundamentally contributory to the establishment of the electric art."

1924.

CRESSON MEDAL AWARDS

1856-1925

ACKER, C. E.

Process of Manufacturing Caustic, etc.—1902.

ALBERT, CHARLES F.

Violins and Bows.—1887.

AMERICAN COTTON COMPANY.

Round Lap Bale System.—1901.

AMERICAN PAPER BOTTLE COMPANY.

Paper Bottles for Various Purposes.—1906.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY.

Contributions to the Modern Telephone Art.—1916.

ATWATER, W. O., and ROSA, E. B.

Respiration Calorimeter.—1900.

AUTOMATIC ELECTRIC COMPANY.

Automatic Telephony.—1910.

BAEYER, J. F. A. VON.

Research Work in Organic Chemistry.—1912.

BALDWIN LOCOMOTIVE WORKS.

Contributions to the Evolution of the American Locomotive.—1907.

BATCHELLER, C. H.

Compound Locomotive.—1893.

BATES, STOCKTON; SHAW, EDWIN, and VON CULIN, G. M.

Spindle Support.—1891.

BELL, ALEXANDER GRAHAM.

Electrical Transmission of Speech.—1912.

BERLINER, EMILE.

Telephony and Sound Reproduction.—1913.

BEVINGTON, J. H.

Welding Metal and Spinning and Shaping Tools.—1891.

BILGRAM, HUGO.

Bevel Gear Cutter.—1887.

BONWILL, W. G. A.

Electro-Magnetic Dental Mallet.—1876.

BORSCH, LOUIS.

Solid Invisible Bifocal Lens.—1907.

BOWER, HENRY.

Inodorous Glycerine.—1878.

BRASHEAR, JOHN A.

Leading Work in Astronomic Science.—1910.

CASTNER, H. Y.

Electrolytic Process of Decomposing Alkaline Chlorides for the Production of Caustic and Chlorine.—1897.

CHABOT, CYPRIEN.

Shoe Sewing Machine.—1885.

CRESSON MEDAL AWARDS

CHAMBERS BROTHERS.

Bolt and Rivet Clipper.—1878.

CHARLTON, J.

Shaft Coupling.—1876.

CLAMER, G. H.

Methods of Eliminating Metals from Mixture of Metals.—1904.

COOPER-HEWITT, P.

Mercury Rectifier.—1910.

CORSCADEN, T.

All-Wrought Steel Belt Pulley.—1898.

COWLES, EUGENE H., AND ALFRED H.

Electric Smelting Furnace.—1887.

COWPER, EDWARD A., AND ROBERTSON, T. HART.

Writing Telegraph.—1889.

CROOKES, SIR WILLIAM.

Discoveries in Chemistry.—1912.

CURIE, PIERRE AND MARIE.

Researches Resulting in the Discovery of Radium.—1909.

DEFOREST, LEE.

The Audion.—1922.

DELANDTSHERE, NORBERT.

Machine for Treating Flax.—1879.

DELANY, P. B.

Synchronous Multiplex Telegraphy.—1886.

DELANY, P. B.

System of Machine Telegraphy.—1896.

DELANY, P. B.

Telepost.—1908.

DIESEL, R.

Diesel Motor.—1901.

DODGE, J. M.

System of Storing Coal.—1904.

DUDLEY, P. H.

Dynamograph.—1877.

EDER, J. MARIA.

Researches in Photochemistry.—1914.

ELDRED, BYRON E.

Low-Expansion Leading-in Wire for Incandescent Electric Lamps.—1921.

EMMET, WILLIAM LEROY.

Work on Electrical Propulsion of Ships and Prime Movers.—1920.

FERRILL, J. L.

Process of Fireproofing Wood.—1903.

FISCHER, EMIL.

Contributions to Organic Chemistry.—1913.

CRESSON MEDAL AWARDS

- FISKE, B. A.
Range Finder.—1892.
- FISS, BARNES, ERBEN & Co.
Worsted Yarns.—1875.
- FORBES, JOHN S., AND WATERHOUSE, A. G.
Art of Automatically Heating and Sterilizing Fluids.—1901.
- FRITZ, JOHN.
Advancement of Steel Industries.—1910.
- GAEDE, W.
Molecular Air Pump.—1909.
- GANS, ROBERT.
Permutit.—1916.
- GAYLEY, J.
Dry Air Blast in Blast Furnace Operation.—1909.
- GILL, W. L.
School City.—1903.
- GOLDSCHMIDT, HANS.
Alumino-thermics.—1904.
- GOLDSCHMIDT, V.
New Theory of Musical Harmony.—1903.
- GRAY, E.
Telautograph.—1897.
- GRAY NATIONAL TELAUTOGRAPH COMPANY.
Telautograph.—1912.
- GRISCOM, W. WOODNUT.
Electric Motor and Battery.—1881.
- HADFIELD, SIR ROBERT A.
Advancement of Metallurgical Science.—1910.
- HAMMER, W. J.
Historic Collection of Incandescent Electric Lamps.—1906.
- HAMMOND, J.
Typewriter.—1890.
- HAUPT, L. M.
Reaction Breakwater.—1901.
- HAYES, MAYER AND COMPANY.
Manufacture of Files.—1890.
- HEANY, J. ALLEN.
Fireproof Insulated Wire.—1907.
- HERSCHEL, CLEMENS.
Venturi Meter.—1898.
- HOLLERITH, H.
Electric Tabulating Device.—1890.
- HOLMES, P. H.
Lubricant Bearing.—1892.

ORESSON MEDAL AWARDS

HOUGH, R. B.

Contributions to the Characteristics and Uses of the American Woods.—1908.

HOWE, H. M.

Experimental Research on Steel.—1895.

HOWE, H. M.

Metallurgy of Steel.—1892.

IVES, FREDERICK E.

Color Photography.—1893.

JENKINS, C. FRANCIS.

"Phantoscope."—1898.

JOHNSON, RAYMOND D.

Hydraulic Valve.—1923.

KINGSBURY, ALBERT.

Thrust Bearing.—1923.

LANSTON, T.

Monotype Machine.—1896.

LEVY, L. E.

Acid Blast Method and Apparatus for Etching Metal Plates.—1900.

LEVY, L. E.

Machine for Powdering Plates for Etching.—1904.

LEWIS, COL. ISAAC NEWTON.

Machine Gun.—1918.

LINDE, KARL P. G.

Refrigeration Processes.—1914.

LOWE, THADDEUS S. C.

Water Gas Process and Apparatus.—1886.

LOVEKIN, L. D.

Expanding and Flanging Machinery and Tools for all Classes of Tubes.—1904.

LUMIÈRE, AUGUSTE AND LOUIS.

Color Photography.—1909.

MALLET, A.

Articulated Compound Locomotive.—1908.

MARKS, G. E.

Improvements in Artificial Limbs.—1893.

MASON AND HAMLIN COMPANY.

Liszt Organ.—1901.

MERGENTHALER, O.

Linotype.—1889.

MICHELSSEN, A. A.

Work in Physical Optics.—1912.

CRESSON MEDAL AWARDS

- MOISSAN, HENRI.
Investigations with the Electric Furnace.—1898.
- MORLEY, E. W.
Determination of Fundamental Magnitudes in Chemistry.—1912.
- NOBLE, ALFRED.
Achievements in Civil Engineering.—1912.
- NORTHROP, EDWIN F.
Electric Furnace and High Temperature Investigations.—1917.
- OLSEN, TINIUS.
Testing Machine.—1891.
- OTT AND BREWER.
China and Porcelain Wares.—1886.
- OUTERBRIDGE, A. E., JR.
Molecular Structure of Cast Iron.—1904.
- OWENS, MICHAEL J.
Bottle Blowing Machine.—1915.
- PARKER, J. C.
Steam Generator.—1902.
- PECKOVER, J.
Stone Sawing Machine.—1895.
- PELTON, LESTER A.
Water Wheel.—1894.
- PENCOYD IRON WORKS.
Bridge Construction.—1900.
- PHILLIPS, F.
Pressed Steel Pulley for Power Transmission.—1907.
- POWERS AND WEIGHTMAN.
Exhibit at The Franklin Institute Exhibition of 1874.—1875.
- PRATT AND WHITNEY COMPANY.
System of Interchangeable Cut Gears.—1886.
- PUPIN, M. I.
Art of Reducing Attenuation of Electrical Waves and Apparatus.—1905.
- RAMSAY, R. H.
Railway Car Transfer Apparatus.—1886.
- RAMSAY, SIR WILLIAM.
Discoveries in Chemistry.—1913.
- RANDOLPH, ISHAM.
Achievements in Civil Engineering.—1913.
- RAYLEIGH, LORD.
Researches in Physical Science.—1913.
- ROBERTSON, T. HART AND COWPER, ED. A.
Writing Telegraph.—1889.
- ROENTGEN, W. C.
Investigations of a New Kind of Ray.—1897.

ORESSON MEDAL AWARDS

ROSCOE, SIR H. E.

Researches in Chemistry.—1912.

RUTHERFORD, SIR ERNEST.

Advancement of Knowledge of Electrical Theory.—1910.

SAUVEUR, A.

Metallography of Iron and Steel.—1910.

SHAW, EDWIN; BATES, STOCKTON; VON CULIN, G. M.

Spindle Support.—1891.

SHAW, THOMAS.

Automatic Device for Testing Mine Gases and System of Mine Signaling.—1887.

SIMONDS, G. F.

Universal Rolling Machine.—1889.

SMITH, EDGAR F.

Work in Electrochemistry.—1914.

SPELLIER, LOUIS H.

Time Telegraph.—1881.

SPRAGUE, F. J.

Multiple Unit System of Electric Traction.—1903.

SQUIER, MAJOR GEO. OWEN.

Multiplex Telephony.—1912.

STEINMETZ, C. P.

Application of Analytics to Electrical Engineering.—1913.

STRATTON, S. W.

Leading Work in Metrology.—1912.

TALBOT, B.

Open Hearth Steel Process.—1909.

TATHAM, W. P.

Printing Press.—1875.

TAYLOR, E. R.

Electric Furnace and Process of Manufacturing Bisulphide of Carbon.—1907.

TAYLOR, FREDERICK W., AND WHITE, MAUNSEL.

Process of Treating Tool Steel.—1902.

TESLA, NIKOLA.

Alternating Electric Currents of High Frequency.—1894.

THOMSON, ELIHU.

Industrial Applications of Electricity.—1912.

THOMSON, JOSEPH J.

Leading Work in Physical Science.—1910.

TILGHMAN, B. C.

Sand Blast.—1875.

TURNER, W. V.

Air Brake Design and Application.—1909.

POTTS MEDAL AWARDS

- U. S. GEOLOGICAL SURVEY.
Exhibit of Survey.—1900.
- UNDERWOOD TYPEWRITER COMPANY.
Typewriter.—1909.
- VAUCLAIN, S. M.
Compound Locomotive.—1891.
- VERNAZ, ALEXIS.
Milling Files.—1909.
- VON CULIN, G. M.; BATES, STOCKTON; SHAW, E.
Spindle Support.—1891.
- WALKUP, L.
Air Brush.—1886.
- WATERHOUSE, A. G., AND FORBES, JOHN S.
Art of Automatically Heating and Sterilizing Fluids.—1901.
- WELSBACH, CARL AUER VON.
Incandescent Mantles.—1901.
- WESTON, EDWARD.
Leading Work in Electrical Discovery and Application.—1910.
- WHITE, MAUNSEL, AND TAYLOR, FREDERICK W.
Process of Treating Tool Steel.—1902.
- WILCKES, J.
"Econometer."—1898.
- WILEY, HARVEY W.
Leading Work in Agricultural Chemistry.—1910.
- WOOD, H. A. WISE.
Autoplate Machine.—1909.
- WRIGHT, ORVILLE.
Work in Aviation.—1914.
- YANKO, PAUL VON.
Piano Keyboard.—1893.
- ZENTMAYER, JOSEPH.
Microscopes and Objectives.—1875.

POTTS MEDAL AWARDS

1911-1925

- ANDERSON, JOHN A.
Work in Spectroscopy and his Seismograph.—1924.
- BARKER, WENDELL A.
Wrenchless Chuck.—1920.
- BIZZELL, JAMES A., AND LYON, T. L.
"Plants and Relation to Nitrate in Soils" (Paper).—1912.

POTTS MEDAL AWARDS

BONE, WILLIAM A.

"Surface Combustion" (Paper).—1913.

BULLARD, EDWARD P., JR.

Mult-Au-Matic Machine Tool.—1920.

COBLENTZ, W. W.

"Reflecting Power of Metals" (Paper).—1911.

COKER, E. G.

Method of Determining Stress by Photo-Elastic Means.—1922.

DAHLGREN, ULRIC.

"The Production of Light by Animals" (Paper).—1917.

DOWNS, CHARLES RAYMOND, AND WEISS, JOHN MORRIS.

Vapor Phase Oxidation of Benzene to Maleic Acid.—1922.

GAERTNER, WILLIAM.

Design and Manufacture of Scientific Instruments.—1923.

GRAY, ALEXANDER.

"Modern Dynamo Electric Machinery" (Paper).—1918.

HULL, ALBERT W.

"The Crystal Structure of the Common Elements" (Paper).—1923.

HUMPHREYS, WILLIAM J.

"The Thunderstorm and Its Phenomena" (Paper).—1915.

JANNEY, REYNOLD, AND WILLIAMS, HARVEY D.

Hydraulic Speed Gear.—1919.

KENNELLY, A. E.

Linear Hot-Wire Anemometer.—1918.

KING, LOUIS V.

Improvements in Linear Hot-Wire Anemometers.—1918.

LANDRETH, CLARENCE P.

Direct Oxidation Process.—1919.

LYON, T. L., AND BIZZELL, JAMES A.

"Plants and Relation to Nitrate in Soils" (Paper).—1912.

MCCOLLUM, E. V.

"Nutrition and Physical Efficiency" (Paper).—1921.

MODJESKI, RALPH.

"Design of Large Bridges with Special Reference to Quebec Bridge" (Paper).—1914.

MOORE, RICHARD B.

"Helium, its History, Properties and Commercial Development" (Paper).—1922.

LEVY AND LONGSTRETH MEDAL AWARDS

MURRAY, W. S.

"Conditions Affecting the Success of Main Line Electrification" (Paper).
—1916.

TATE, ALFRED O.

Electrolytic Waterproofing of Textile Fabrics.—1921.

WEISS, JOHN MORRIS, AND DOWNS, CHARLES RAYMOND.

Vapor Phase Oxidation of Benzene to Maleic Acid.—1922.

WILLIAMS, HARVEY D., AND JANNEY, REYNOLD.

Hydraulic Speed Gear.—1919.

LEVY MEDAL AWARDS

1924-1925

FLETCHER, HARVEY.

"Physical Measurements of Audition and Their Bearing on the Theory of Hearing" (Paper).—1924.

HAYES, HARVEY C.

"Measuring Ocean Depths by Acoustical Methods" (Paper).—1925.

LONGSTRETH MEDAL AWARDS

1890-1925

ABBE, C.

"Meteorology" (Paper).—1913.

ABBOTT, ROBERT R.

"Modern Steels and Their Heat Treatment" (Paper).—1916.

ACHARD, F. H., KENNELLY, A. E., AND DANA, A. S.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—
1917.

ADAMS, L. H., AND WILLIAMSON, E. D.

"The Annealing of Glass" (Paper).—1921.

ADAMS, W. G., AND FORBES, J. S.

Stop Valve for Radiators.—1893.

ALEXANDER, JOHN E.

"Phonosphere."—1905.

ALTENDER, THEODORE AND SONS.

Drawing Pen.—1905.

ARMSTRONG, WM. T., AND COX, JACOB D.

Grip Socket.—1896.

ARNOLD, B. J.

Magnetic Clutches and System of Electric Power Station Construction.—
1903.

AUSTIN, JOHN T.

Austin Organ.—1917.

LONGSTRETH MEDAL AWARDS

- BALL, JOHN D.
"Investigations of Magnetic Laws for Steel and Other Materials"
(Paper).—1917.
- BASKERVILLE, C.
"Chemistry of Anæsthetics" (Paper).—1912.
- BATES, E. G.
Typographic Numbering Machine.—1895.
- BAUSH, CHRISTIAN H.
Radial Drilling Machine.—1894.
- BECKER, CHRISTOPHER A.
Chainomatic Balance.—1917.
- BENNETT, CHARLES A.
Typewriter.—1909.
- BERGONIE, J.
Use of A. C. Electro-Magnet in Surgery.—1921.
- BLOEDE, V. G.
Process of Tinting Fabrics.—1894.
- BONNELL, RUSSELL, AND SCHMITT, HENRY J.
Gate Valves.—1901.
- BBADBURN AND PENNOCK.
Process of Obtaining Alumina from Bauxite.—1893.
- BRANDT, EDWARD J.
Automatic Cashier.—1922.
- BREED, G.
Apparatus for Producing Musical Sounds by Electricity.—1908.
- BRISTOL, W. H.
Recording Pressure Gauge.—1894.
- BROWN, HAROLD P., AND EDISON, THOMAS A.
Rail Bonds and Electrical Contacts.—1899.
- CAFFREY, C. S., AND COMPANY.
Improvement in Carriages and Wagons.—1900.
- CARTY, J. J.
Bridging Bell System.—1905.
- CHAFFEE, E. L.
"Continuous Electric Oscillations" (Paper).—1913.
- CHANCE, E. M.
"Pathogenic Mine Atmospheres" (Paper).—1912.
- CHENEY, W. L.
Lathe Tool and Support.—1895.
- CHENOWETH, A. C.
Method of Constructing Sewers.—1892.
- CLARK, WM. H., AND COLLINS, FRANK W.
Ventilating Stove.—1894.
- COLLINS, FRANK W., AND CLARK, WM. H.
Ventilating Stove.—1894.

LONGSTRETH MEDAL AWARDS

COLT'S PATENT FIRE ARMS MANUFACTURING COMPANY.

Automatic Pistols.—1906.

COOPER, W. S.

Specimens of Aluminum Castings.—1895.

COX, JACOB D., AND ARMSTRONG, WM. T.

Grip Socket.—1896.

CREIGHTON, H. JERMAIN.

"The Deteriorating Action of Salt and Brine on Reinforced Concrete"
(Paper).—1918.

CRISFIELD, J. A. P.

Moisture Determinator for Coke and the Like.—1909.

CUMMINGS, H. H.

Speed Controllers.—1903.

CUSHMAN, ALLERTON S.

"Researches on the Corrosion of Iron and Steel" (Paper).—1908.

DANA, A. S., KENNELLY, A. E., AND ACHARD, F. H.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—
1917.

DESHLER, CHARLES, AND McALLISTER, EDWARD J.

Portable Photometer.—1900.

DEVÖE, W. R.

Conduit Electric Railway.—1894.

DODGE, WALLACE H.

Wooden Split Pulley.—1891.

DOOLITTLE, T. B.

Hard Drawn Copper Wire.—1898.

DRAPER, C. W.

Computing Machine with Indicating and Registering Mechanism.—1904.

EBERHARDT, HENRY F., AND ULRICH, F. L.

Radial Gang Cutter.—1904.

EDDISON, WILLIAM BARTON.

Jet Entraining Apparatus.—1921.

EDISON, THOMAS A., AND BROWN, HAROLD P.

Rail Bonds and Electrical Contacts.—1899.

EDWARDS, LEVI TALBOT.

Compound Air-Lift System.—1918.

ELLIOTT, WILLIAM SWAN.

Process and Apparatus for the Deaeration of Liquids.—1924.

ELLIS, CARLETON.

Paint and Varnish Remover.—1916.

EVE, A. S.

"Modern Views on the Constitution of the Atom" (Paper).—1916.

FAY, C. N., SHOLES, Z. G., AND HOCHKLASSEN, H.

Typewriting Machine.—1901.

LONGSTRETH MEDAL AWARDS

- FOLLETT, W. I.
Time Stamp.—1906.
- FOLMER AND SCHWING MFG. COMPANY.
Graflex Cameras.—1905.
- FORBES, J. S., AND ADAMS, W. G.
Stop Valve for Radiators.—1893.
- FREAS, SAMUEL T.
"Interlocking" Tooth Saw.—1922.
- FRICK, FRED.
Electric Program Clock.—1899.
- FULLER, G. W.
"Biochemical and Engineering Aspects of Sanitary Water Supply"
(Paper).—1916.
- GOLDMAN, HENRY.
Arithmachine.—1901.
- GOODYEAR, CHARLES.
Projection Lantern.—1895.
- GRANBERY, J. H.
Stadia Rod.—1909.
- HARTNESS, JAMES.
Screw Thread Comparator.—1922.
- HEILPRIN, A.
Improved Ventilating Car Window.—1897.
- HENNING, G. C.
Pocket Recorder for Tests of Materials.—1899.
- HEPBURN, J. S.
"Chemistry of Sugar" (Paper).—1911.
- HERR, H. T.
"Development of Steam Turbines" (Paper).—1914.
- HICKS, THOMAS WILLING.
"Once-Over" Tiller.—1922.
- HILL, F. B.
Improvement in the Treatment of Sewage.—1893.
- HIRSCH, H. H.
Electric Safety Lamp.—1914.
- HITE, B. H.
Sterilization by High Pressure.—1920.
- HOADLEY, H. G.; WILLIAMS, H. D.; AND LEWIS, E. C.
Lever and Ratch Attachment.—1900.
- HOCHKLASSEN, H.; FAY, C. N., AND SHOLES, Z. G.
Typewriting Machine.—1901.
- HOLLINGSHEAD, W. B.
Automatic Disinfectant Ejector.—1898.
- HOLMAN, A. J. AND COMPANY.
Self-Pronouncing Bibles.—1900.

LONGSTRETH MEDAL AWARDS

HOOVEN, OWENS, RENTSCHLER CO.

Hooven Automatic Typewriter.—1917.

HUMPHREYS, W. J.

"Volcanic Dust, Climatic Changes and Ice Ages" (Paper).—1914.

HYDE, E. P.

"Physical Production of Light" (Paper).—1911.

INTERNATIONAL LIGHT, HEAT AND POWER COMPANY.

Incandescent Lamp.—1901.

INTERNATIONAL MONEY MACHINE COMPANY.

Money Machine.—1917.

IVES, H. E.; KINGSBURY, E. F.; AND KARRER, E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

IVES, H. E.

"Artificial Daylight" (Paper).—1915.

IVES, H. E.

Improvements in Diffraction Color Photographs and Mode of Making Same.—1907.

IVES, F. E.

Photo-Micrographic Process.—1903.

IVINS, E.

Product of Tube Making.—1894.

JOHNSTON, A. L.

Automatic Safe Electric Disconnecter.—1894.

JONES, H. C.

"Nature of Solution" (Paper).—1913.

JONES, J. R.

Machine for Rolling Car Wheels.—1892.

KARNS, J. P., COMPANY.

Tunneling Machine.—1909.

KARRER, E.; KINGSBURY, E. F.; AND IVES, H. E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

KELLER, JOSEPH F.

Automatic Die Cutting Machine.—1922.

KEMP, W. W., AND VAN HORN, W. H.

Gas System.—1919.

KENNELLEY, A. E.; ACHARD, F. H.; AND DANA, A. S.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—1917.

KINGSBURY, E. F.; KARRER, E.; AND IVES, H. E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

KINKEAD MANUFACTURING COMPANY.

Apparatus for Aligning and Levelling Shafting.—1914.

KITSON, A.

System of Oil Heating and Incandescent Lighting.—1901.

LONGSTRETH MEDAL AWARDS

KNAPP, I. N.

"Natural Gas" (Paper).—1913.

KOTHNY, G. L., AND SUCZEK, ROBERT.

Radojet Air Pump.—1920.

KROLL, G.

Convertible Carriage.—1896.

LAIRD, SCHOBBER AND COMPANY.

General Excellence in Manufacturing Shoes.—1900.

LATHROP, E., AND SCHREINER, O.

"Organic Constituents in Soil" (Paper).—1912.

LEDoux, J. W.

Fluid Meter.—1919.

LEEDS, MORRIS E.

Recording Devices.—1920.

LENKER, WILL G.

L-E-Vation Rod.—1915.

LEVY, MAX.

Counting Chamber for Haemocytometer.—1917.

LEWIS, E. C.; WILLIAMS, H. D.; AND HOADLEY, H. G.

Lever and Ratch Attachment.—1900.

LEWIS, JOHN F., AND MATTES, WM. F.

Locomotive Cylinder Lubricator.—1894.

LEWIS, W.

Inertia Indicator.—1899.

LLOYD, M. G.

"Magnetic Hysteresis" (Paper).—1911.

LODGE, GEORGE.

Electro-Magnetic Street Railway System.—1896.

LUCKIESH, M.

"The Visibility of Airplanes" (Paper).—1920.

LUPTON, D., SON AND COMPANY.

Automatic Closing Fireproof Metal Window.—1904.

MACKAY, WILLIAM M.

Operating Valve.—1893.

MCALLISTER, E. J., AND DESCHLER, CHARLES.

Portable Photometer.—1900.

MCBRIDE, THOMAS C.

Locomotive Feed Water Heater.—1924.

MARSH, E. B.

Metallic Corner Bead.—1897.

MATTES, WILLIAM F., AND LEWIS, J. F.

Locomotive Cylinder Lubricator.—1894.

MEEKER, G. H.

New Apparatus and Method in Clinical Chemistry.—1906.

LONGSTRETH MEDAL AWARDS

MENLO PARK CERAMIC WORKS.

Decorative Tile and Faience Work.—1890.

MILEY, HENRY M., AND MICHAEL.

Color Photography.—1905.

MILLER, DAYTON C.

"A 32-Element Harmonic Synthesizer" (Paper).—1917.

MOORE, RICHARD B.

"Biography of Sir William Ramsay" (Paper).—1919.

MORSELL, W. F. C.

Sectional Models for Stereometric Representation.—1903.

NACHOD, CARL P.

Electric Railway Signal System.—1924.

NOISELESS TYPEWRITER COMPANY.

Typewriter.—1922.

NORTHRUP, E. F.

"Vortex Motion in Liquids" (Paper).—1912.

PANTASOTE LEATHER COMPANY.

"Pantasote."—1896.

PARKE, HARRY S.,

Pneumercator Tank and Draft Gauge.—1923.

PFUND, A. H.

Colorimeter, Cryptometer, Paint Film Gauge and Rotating Sector.—1922.

PHILADELPHIA CREMATION SOCIETY.

System of Cremation.—1892.

PITKIN, A. J.

Compound Locomotive.—1891.

PITTLER, J. W. VON.

Turret Lathe.—1903.

PRESTWICH, JOHN ALFRED.

Fluid Gauge.—1918.

RANKIN, GEORGE A.

"Portland Cement" (Paper).—1917.

RECKLINGHAUSEN, M. VON.

"Ultra-Violet Rays" (Paper).—1915.

REESE, B. D.

Dirigible Balloon.—1910.

REEVES, MILTON O.

Variable Speed Countershaft.—1900.

REGAN, H. C., JR.

Closed Conduit Electric Railway.—1897.

RICHARDS, G. M.

Automatic Fluid Pressure Friction Clutch.—1897.

RIKER, C. L.

Lavatory.—1900.

LONGSTRETH MEDAL AWARDS

- RINGLAND, ALBERT, AND SCHOENFUSS, F. H.
Portable Brinell Meter.—1917.
- ROBY, HENRY W.
Screw Jack.—1891.
- ROEDER, J. R.
Improvement in Windows.—1892.
- ROPER, CHARLES.
Safety Propellers.—1909.
- ROSENDALE BELTING COMPANY.
Camel Hair Belting.—1893.
- ROUSSEL, W. J.
Cipher Code System.—1902.
- RUSBY, J. M.
"Industrial Combustible Gases" (Paper).—1914.
- RUSHTON, K.
Improvements in Trailing Trucks for Locomotives.—1910.
- RUUD, EDWIN.
Instantaneous Automatic Water Heater.—1904.
- SCHEMERHORN, W. GEORGE.
Folding Boat.—1891.
- SCHLINK, FREDERICK J.
Stabilized Platform Weighing Scale.—1919.
- SCHMIDT, MAX, AND SIEBER, JOSEPH.
Movable Sidewalk.—1894.
- SCHMIDT, HENRY J., AND BONNELL, RUSSELL.
Gate Valves.—1901.
- SCHOENFUSS, FRANK H., AND RINGLAND, ALBERT.
Portable Brinell Meter.—1917.
- SCHREINER, O., AND LATHROP, E.
"Organic Constituents in Soils" (Paper).—1912.
- SCRIPTURE, E. W.
Color Sense Tester.—1903.
- SEITZ, HENRY JEROME.
Coal Loading and Screening Machines.—1904.
- SHARPLES, SPECIALTY COMPANY.
Super-Centrifuge.—1916.
- SHAW, H. M.
Lightning Arrester.—1904.
- SHEEN, MILTON ROY.
Expansion Machine for Tunnel Construction.—1924.
- SHELLENBACH, WILLIAM L.
Variable Speed Countershaft.—1903.
- SHOLES, Z. K.; FAY, C. N.; AND HOCHKLASSEN, H.
Typewriting Machine.—1901.
- SIEBER, JOSEPH, AND SCHMIDT, MAX E.
Movable Sidewalk.—1894.

LONGSTRETH MEDAL AWARDS

- SKINNER, JOSHUA J.
"Soil Aldehydes" (Paper).—1919.
- SNOOK, HOMER CLYDE.
X-Ray System.—1919.
- SOCIÉTÉ GENEVOISE.
Measuring Machine.—1923.
- SPITZGLASS, JACOB M.
Republic Flow Meter.—1921.
- STAR BRASS MANUFACTURING COMPANY.
Steam Gauge.—1894.
- STEARNS MANUFACTURING COMPANY.
Automatic High Speed Engine.—1892.
- STONE, JOHN STONE.
"Propagation of Electric Waves Along Wires" (Paper).—1913.
- STRADLING, GEORGE F.
"Modern Theories of Magnetism" (Paper).—1916.
- STUMPF, J.
Una Flow Steam Engine.—1909.
- SUCZEK, ROBERT, AND KOTHNY, G. L.
Radojet Air Pump.—1920.
- TAINTOR, C. C.
Positive Saw-Set.—1895.
- TAUSSIG, JOHN H., AND ZEEK, CHARLES F.
Automatic Operation of Water Gas Sets.—1918.
- TEAL, B. F.
Anti-friction Universal Joint for Shafting.—1909.
- THOMAS, C. C.
"Measurement of Gases" (Paper).—1912.
- TIERNAN, MARTIN F., AND WALLACE, C. F.
Chlorinator.—1922.
- TOERRING, C. J.
Electric Arc Lamp.—1903.
- TOWNSEND, T. F.
Improved Thermometer Support.—1907.
- TUCKER, W. H.
Letter and Document Files.—1900.
- TURNER, W. V.
"Locomotive Air-Brake" (Paper).—1911.
- TUTWILER, C. C.
"Recovery of Gas Works by-Products" (Paper).—1915.
- ULRICH, FREDERICK L., AND EBERHARDT, H. E.
Radial-Duplex Gang Cutters.—1904.
- UNDERWOOD, JOHN, AND COMPANY.
Combined Calculating and Typewriting Machine.—1915.

LONGSTRETH MEDAL AWARDS

VAN ALLER, TYCHO.

Calorizing Process.—1918.

VAN HORN, WILLIAM H., AND KEMP, WILLIAM W.

Kemp Gas System.—1919.

WAGGNER, B. G.

Prepayment Gas Meter.—1916.

WAGNER ELECTRIC MANUFACTURING COMPANY.

Single Phase Alternating Current Power Motor.—1902.

WAHL ADDING MACHINE COMPANY.

Adding Machine.—1916.

WALLACE, C. F., AND TIERNAN, MARTIN F.

Chlorinator.—1922.

WATERBURY TOOL COMPANY.

Double Universal Joint.—1904.

WEIDLOG, CHARLES B.

Indicator for Boring Machines.—1906.

WELSBACH LIGHT COMPANY.

Various Manufactured Products.—1901.

WENTWORTH, C. C.

Improvements in Hydraulic Rams.—1903.

WETHERILL, HENRY EMERSON.

New Physical Diagnostic Instruments.—1906.

WHEELER, GEORGE A.

Step Type Escalator.—1914.

WHITE, J. J.

Journal Box.—1891.

WHITEHEAD, J. B.

"The Electric Strength of Air and Methods of Measuring High Voltage"
(Paper).—1918.

WILLIAMS, BROWN AND EARLE.

Kerosene Lamp for Magic Lanterns.—1902.

WILLIAMS, H. D.; HOADLEY, H. G.; AND LEWIS, E. C.

Lever and Ratch Attachment.—1900.

WILLIAMSON, E. D., AND ADAMS, L. H.

"The Annealing of Glass" (Paper).—1921.

YAWMAN & ERBE MANUFACTURING COMPANY.

Rapid Roller Copier.—1904.

YOUNG, C. D.

"Locomotive Superheaters" (Paper).—1915.

ZEEK, CHARLES F., AND TAUSSIG, JOHN H.

Automatic Operation of Water Gas Sets.—1918.

ZIMMERMANN, WILLIAM F.

Hob for Worm Gears.—1924.

CERTIFICATE OF MERIT AWARDS

1885-1925

BAYLIS, R. N.

Brush Holder and Brusher for Dynamos.—1909.

BEIN, EMIL J.

Letter and Document Files.—1900.

BINGHAM, EUGENE C.

Viscometer.—1922.

BLANTON, E. A., JR.

Shaft Coupling, Nut Locks, Cams, etc.—1910.

BLONCK, W. A.

Boiler Efficiency Meter.—1914.

BLOUNT, EUGENE I., AND TAYLOR, WARREN H.

Door Check.—1902.

BRANCH, C. J.

Electric Light Shade.—1909.

BULLARD, REAR ADMIRAL W. H. G.

"The Application of Radio to Navigation Problems" (Paper).—1922.

BYERLY, F. E.

Cutter and Cutter Head.—1893.

CANDEE, C. H.

Car Truck and Journal Bearings.—1887.

COOK, J. S.

Self-Lubricating Journal Box.—1898.

DEMPSTER, J. T. H.; FLEMING, RICHARD; GENERAL ELECTRIC COMPANY;
AND STEINMETZ, C. P.

Magnetite Lamp.—1908.

DERYCKE, J.

Steam Separator.—1894.

DODGE, W. W.

Wooden Split Pulley.—1885.

DUNN, G. S.

Automatic Electric Brake Motor.—1902.

ELLSWORTH, F. G.

The Knudson and Ellsworth Telephone.—1891.

ELTONHEAD, W. B.

Nut Lock.—1885.

ETCHELLS, HARRY, AND GRAVES, H. A.

Electric Arc Furnace.—1922.

FLEMING, RICHARD; DEMPSTER, J. T. H.; GENERAL ELECTRIC COMPANY;
AND STEINMETZ, C. P.

Magnetite Lamp.—1908.

GENERAL ELECTRIC COMPANY; DEMPSTER, J. T. H.; FLEMING, RICHARD;
AND STEINMETZ, C. P.

Magnetite Lamp.—1908.

CERTIFICATE OF MERIT AWARDS

GETTY, JOHN K.

Bicycle Support.—1896.

GILSON, EMERY G.

Calorizing Process.—1918.

GLAZIER, JOHN T. AND PETER F.

Universal Nozzle.—1904.

GOWDEY, J.

Compartment Drawer.—1902.

GREAVES, H. A., AND ETCHHELLS, HARRY.

Electric Arc Furnace.—1922.

GREENE, F. V. AND M. A.

Improvement in Windows.—1892.

HAINES, R. B., JR.

Automatic Micrometer Gauge for Hot Metal.—1896.

HALLANAN, M.

Horseshoe and Pad.—1896.

HALLBERG, J. H.

Current System for Trunk Line Railways.—1906.

HANSON, FREEMAN.

Wood Turning Machine.—1891.

HARBOLSHHEIMER, J.

Garbage Box.—1894.

HAVARD, OLIVER D.

Coal Meter.—1918.

HAYS, CHARLES AND JOSEPH.

CO₂ and Draft Recorder.—1920.

HEPBURN, J. S.; ST. JOHN, E. Q.; AND JONES, F. M.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

HILL, EDGAR.

Caliper Measuring Device.—1903.

HILL, MYRON F.

Roller Bearings.—1902.

INTERNATIONAL BURGLAR IMMUNITY CO.

Electric Protective Devices.—1905.

JONES, FRANK MORTON; HEPBURN, J. S.; AND ST. JOHN, E. Q.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

KIDDE, WALTER, AND COMPANY.

Improved System of Detecting and Extinguishing Marine Fires.—1922.

KINNEY, R. D.

Internal Fired Water Tube Boiler.—1899.

CERTIFICATE OF MERIT AWARDS

LANCE, W. L.

Utilizing Oil Cloth Waste.—1888.

LAND, S.

Sash Cord Fastener.—1886.

LANDAU, DAVID, AND PARR, PERCY H.

"A New Theory of Plate Springs" (Paper).—1920.

MCCHESNEY, R.

Improvements in T-Squares.—1893.

MACDONALD, THOMAS H.

Apparatus for Recording Sound.—1900.

MCINTYRE COMPANY.

Electric Wire.—1893.

MCLAUTHLIN, MARTIN B., AND TAYLOR, GEORGE.

Household Garbage Carbonizer.—1895.

MAXON, HARRY R.

Pre-mix Burner.—1923.

MENDENHALL, CHARLES E.

"Aeronautic Instruments" (Paper).—1922.

NABER, H. A.

Gas Voltameter.—1895.

NATIONAL NUTRIENT COMPANY.

Nutrium, a new food Product.—1902.

NEUMEYER, H. F.

Spray Nozzle.—1895.

NOUY, P. LECOMTE DU.

Surface Tension Apparatus.—1923.

PARR, PERCY H., AND LANDAU, DAVID.

"A New Theory of Plate Springs" (Paper).—1920.

PARVIN, A. B.

Tele-photo Lens.—1895.

PHELPS, W. J.

Hylo-Incandescent Lamp.—1903.

PICH, FRIEDRICH.

Cast Iron Brazing.—1903.

PITNEY, ARTHUR H.

Postage Meter.—1922.

REAGAN, JAMES.

Improved Gates.—1900.

RIDGWAY, E. B.

Steam Hydraulic Elevator.—1914.

RINN, J. J.

Tent Fastening.—1904.

ROBINSON, CYRUS R.

Improved Fire Nozzle.—1905.

CERTIFICATE OF MERIT AWARDS

ROLIN, CHARLES W.

Adjustable and Interchangeable Grate.—1918.

ROWLAND, L. G.

Automatic Safety Device for Electric Circuits.—1897.

SADTLER, J. P. B.

Water Heater for Range Boilers.—1900.

SCHENCK, W. T. Y.

Improved Hose Reels.—1893.

SHEAF, PHILIP A.

Circle Drawing Attachment for Microscopes.—1916.

SIMPSON, W. L.

Steam Separator.—1894.

STEIN, F. J.

An improved and Simplified System of Pitman Phonography.—1904.

STEINMETZ, C. P.; DEMPSTER, J. T. H.; FLEMING, RICHARD; AND GENERAL
ELECTRIC COMPANY.

Magnetite Lamp.—1908.

ST. JOHN, E. Q.; HEPBURN, J. S.; AND JONES, F. M.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the
Sarraceniaceæ" (Paper).—1921.

SWEETLAND, ERNEST J.

Metallic Filter Cloth.—1918.

SWETT AND LEWIS COMPANY.

Static Machine for X-Ray Apparatus.—1899.

TAYLOR, GEORGE, AND McLAUTHLIN, MARTIN B.

Household Garbage Carbonizer.—1895.

TAYLOR, WARREN H., AND BLOUNT, EUGENE I.

Door Check.—1902.

TUCKFIELD, C. B.

Stove Pipe Anchor.—1896.

VANIER, G. P.

Potash Bulb.—1914.

WARDEN, J. T.

Improved Drawing Board.—1893.

WEBER, GEORGE AND WILLIAM.

Speaking Attachment for Telephone.—1894.

WHINERY, SAMUEL BRENT.

Improved Method of Blueprinting.—1902.

WHITE, E. M.

Chimney for Incandescent Lamp.—1898.

WICKERSHAM, W.

Printers' Quoin.—1894.

WILKES, M.

Automatic Cut-Off for Slide Valve Engines.—1889.

TERMS AND PRIVILEGES OF MEMBERSHIP

Members of the Institute shall consist of those engaged or interested in scientific pursuits or in the application of science in the mechanic and industrial arts. Members shall be classed as follows: Honorary and Corresponding, Endowment, Life, Contributing, Resident, Non-resident, Holders of Second Class stock.

Honorary and Corresponding members shall be nominated by the Board of Managers and shall require for their election four-fifths of the votes of the members present at any stated meeting of the Institute at which their nomination may be acted upon. They shall not be entitled to vote or hold office. All other members shall be elected by the Board of Managers.

Endowment members shall consist of persons, firms, corporations or associations who shall make an endowment payment of Five Thousand Dollars (\$5000) to the Institute, and who, upon acceptance thereof by the Board of Managers, shall thereafter have the privilege of nominating annually to the Board of Managers for election (subject to its discretion as to any particular nominee) as Resident members of the Institute for its then current year without payment of dues that number of persons, to be determined from time to time by the Board of Managers, whose annual dues if they were paying annual Resident Membership dues would approximately equal but not exceed the then current income from such endowment payments. Such Endowment Memberships shall be perpetual, and shall be transferable by the holders thereof by will or otherwise: Provided, however, that the Board of Managers at any time may refund Five Thousand Dollars (\$5000) to the then holders of any such membership, and annul and terminate that membership.

Resident Life members, whose memberships shall not be transferable, shall pay the sum of Three Hundred Dollars (\$300) in any one year. Non-resident Life members shall be those who reside permanently at a distance of not less than twenty-five miles from Philadelphia and shall pay the sum of One Hundred Dollars (\$100) in any one year.

Contributing members shall consist of firms, corporations, associations or individuals who shall pay annually the sum of Three Hundred Dollars (\$300). A Contributing member shall have the privilege of nominating nineteen persons to the Board of Managers for election as Resident members for the year then current, subject to the discretion of the Board as to any particular nominee, and members thus elected shall pay no dues.

Resident members shall pay annual dues of Fifteen Dollars (\$15).

Second Class Stock may be purchased for ten dollars per share and holders are entitled to all the privileges of membership so long as they make the annual payment of twelve dollars.

Non-resident members shall be those who reside permanently at a distance of not less than twenty-five miles from Philadelphia. They shall pay an entrance fee of Five Dollars and annual dues of Five Dollars. Transfers of membership from the Resident to Non-resident class may be granted by the

Board of Managers at its discretion in cases of temporary absence of members from the city for a period of not less than one year.

Resignations must be made in writing, and dues must be paid to the date of resignation.

For further information and membership application blanks address the SECRETARY OF THE INSTITUTE.

Membership Badges.—Pin or button form, may be purchased from the Controller for One Dollar. All badges are numbered and the owner's name and number recorded.

MEMBERSHIP DIRECTORY

HONORARY MEMBERS

- Brigadier General JAMES ALLEN, U. S. A. (Retired), Army and Navy Club, Washington, D. C.
 Colonel GEORGE L. ANDERSON, U. S. A. (Retired).
 Prof. SVANTE AUGUST ARRHENIUS, Nobel Institute, Stockholm, Sweden.
 Brigadier General JOHN J. CARTY, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
 Prof. CHARLES F. CHANDLER, 51 East 54th Street, New York City, New York.
 Mr. THOMAS A. EDISON, Orange, New Jersey.
 Prof. CHARLES FABRY, Professor of Physics, University of Paris, 1 Rue Victor-Cousin, Paris (5e), France.
 General G. FERRIE, Inspecteur des Services de la Telegraphie Militaire et des Transmissions, 51 bis, Boulevard Latour-Maubourg, Paris, France.
 Prof. GEORGE FORBES, No. 11 Little College Street, Westminster, S. W., London, England.
 Prof. HENDRIK A. LORENTZ, Zylweg 76, Haarlem, Holland.
 Senator GUGLIELMO MARCONI, Royal Italian Senate, Rome, Italy.
 Dr. A. A. MICHELSON, Professor of Physics, University of Chicago, Chicago, Illinois.
 Dr. RALPH MODJESKI, 818 Widener Building, Philadelphia, Pennsylvania.
 Rear Admiral JOSEPH B. MURDOCK, U. S. N. (Retired), Danbury, New Hampshire.
 Prof. HEIKE KAMERLINGH ONNES, University of Leiden, Leiden, Holland.
 The Hon. Sir CHARLES A. PARSONS, 6 Windsor Terrace, Newcastle-On-Tyne, England.
 General JOHN J. PERSHING, War Department, Washington, D. C.
 Mr. RALPH W. POPE, 570 Cherry Street, Elizabeth, New Jersey.
 Sir ERNEST RUTHERFORD, Cavendish, Professor of Experimental Physics, The University of Cambridge, Cambridge, England.
 Prof. THEODORE WILLIAM RICHARDS, Wolcott Gibbs Memorial Laboratory, Harvard University, Cambridge, Massachusetts.
 Rear Admiral WILLIAM S. SIMS, U. S. N., General Board, Naval War College, Newport, Rhode Island.
 Mr. FRANK J. SPRAGUE, Consulting Engineer, President, Sprague Safety Control and Signal Corporation, 421 Canal Street, New York City, New York.
 HON. WILLIAM C. SPROUL, 117 South Sixteenth Street, Philadelphia, Pennsylvania.
 Major-General GEORGE OWEN SQUIER, War Department, Washington, D. C.
 Rear Admiral DAVID WATSON TAYLOR, U. S. N., 1813 19th Street, N. W., Washington, D. C.
 Dr. ELIHU THOMSON, 22 Monument Avenue, Swampscott, Massachusetts.
 Sir JOSEPH J. THOMSON, Trinity College, Cambridge, England.
 Prof. WILLIAM CAWTHORNE UNWIN, Palace Gate Mansions, Kensington, London, England.
 Dr. EDWARD WESTON, President, Weston Electrical Instrument Company, Newark, New Jersey.
 Dr. H. W. WILEY, Room 1120, Woodward Building, Washington, D. C.
 Dr. PIETER ZEEMAN, Stadheuderskade 158, Amsterdam, Holland.

CORRESPONDING MEMBERS

- Professor A. S. EVE, McGill University, Montreal, Canada.
 Prof. JOHN SEALY TOWNSEND, New College, Oxford, England.

IN MEMORIAM

Mr. ISAAC B. THORN.

MEMBERS

- ABBOTT, ROBERT R., Metallurgical Engineer, The Peerless Motor Car Company, Cleveland, Ohio.
 ABRAMS, PETER, 918 Chestnut Street, Philadelphia, Pennsylvania.
 ACHESON, Dr. EDWARD G., Manufacturer, Acheson Corporation, Aeolian Building, 35 West 42nd Street, New York City, New York.
 ADAMS, HOWARD L., Managing Director, Keystone Institute, Reading, Pennsylvania.
 ADAMS, MERRITT H., 373 Madison Avenue, Flushing, New York.
 ADDICKS, WALTER R., President, Consolidated Gas Company of New York, 130 E. 15th Street, New York City, New York.
 ADSIT, CHARLES G., Engineer, 555 Electric and Gas Building, Atlanta, Georgia.
 AERTSEN, GUILLIAEM, Engineer, Bethlehem Steel Company, 1637 Widener Building, Philadelphia, Pennsylvania.
 AKELEY, CARL E., Taxidermist and Sculptor, American Museum of Natural History, 77th Street and Central Park West, New York City, New York.
 AKERLOW, G. W., Mechanical Engineer, Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania, and for mail, 5342 Larchwood Avenue, Philadelphia, Pennsylvania.

- AKIMOFF, NICHOLAS W.**, Mechanical and Hydraulic Engineer, 1013 Harrison Building, Philadelphia, Pennsylvania.
- ALBRECHT, A. C.**, Vice-President, North Bros. Manufacturing Company, Lehigh Avenue and American Street, Philadelphia, Pennsylvania.
- ALBRECHT, HERMAN C.**, Electrical Engineer, Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- ALLAN, ANDREW, Jr.**, Manufacturer of Bearing Metals, Harrison, New Jersey.
- ALLEMAN, GELLERT**, Professor of Chemistry, Swarthmore College, and for mail, 8 Whittier Place, Swarthmore, Pennsylvania.
- ALLEN, ARTHUR HARTMAN, Jr.**, Inventor, Victor Talking Machine Company, Camden, New Jersey, and for mail, 4019 Baring Street, Philadelphia, Pennsylvania.
- ALLEN, HENRY B.**, Metallurgical Engineer, 8112 St. Martin's Lane, Chestnut Hill, Philadelphia, Pennsylvania.
- ALLEN, JAMES**, Brigadier General, U. S. A., Army and Navy Club, Washington, D. C.
- ALLEN, WILLIAM N.**, Retired Chemical Manufacturer, 557 Church Lane, Germantown, Philadelphia, Pennsylvania.
- ALSBERG, Dr. CARL L.**, Stanford University, California.
- AMES, Dr. JOSEPH S.**, Director Physical Laboratory, The Johns Hopkins University, Baltimore, Maryland.
- ANDERSEN, OLAF**, Geologist, Norges Geologiske Undersokilse, Kronprinsensgt 2, Kristiania, Norway.
- ANDERSON, CYRUS N.**, Patent Lawyer (Attorney-at-Law), 519 Land Title Building, Philadelphia, Pennsylvania, and for mail, 440 Haverford Road, Narberth, Pennsylvania.
- ANDERSON, FRANK**, Mining Engineer, 1172 Harvard Avenue, Salt Lake City, Utah.
- ANDERSON, Colonel GEORGE L.**, U. S. A., Electrical Engineer, Address unknown.
- ANDERSON, ROBERT J.**, P. O. Box 111, Fenway Station, Boston, Massachusetts.
- ANDREAU, ROLAND L.**, Consulting Chemical Engineer and Research Chemist, Laurel Springs, New Jersey.
- ANDREWS, W. S.**, Consulting Electrical Engineer, General Electric Company, Schenectady, New York.
- ANGERER, VICTOR**, Vice-President, Taylor-Wharton Iron and Steel Company, P. O. Box 162, Ridley Park, Pennsylvania.
- ARMSTRONG, WILLIAM R.**, Clerk, Powers-Weightman-Rosengarten Company, Philadelphia, Pennsylvania.
- ARNOLD, Dr. H. D.**, Director of Research, Engineering Department, Western Electric Company, New York City, N. Y.
- ARNY, Dr. H. V.**, Teacher and Chemist, 115 West 68th Street, New York City, New York.
- ARRHENIUS, SVANTE AUGUST**, Physicist, Nobel Institute, Stockholm, Sweden.
- ASEF, Dr. WALDEMAR**, Research Chemist, Research Department, Pennsylvania Salt Manufacturing Company, Greenwich Point, Philadelphia, Pennsylvania.
- ASHBROOK, Dr. DONALD S.**, Chemist, 2404 Willard Street, Wilmington, Delaware.
- ASHHURST, JOHN**, Librarian, The Free Library of Philadelphia, 13th and Locust Streets, Philadelphia, Pennsylvania.
- ASHMEAD, FRANK M.**, Civil Engineer, 3016 Euclid Avenue, Cleveland, Ohio.
- ATKINSON, ROBERT**, Box 633, Newtown, Pennsylvania.
- ATLEE, JOSHUA W.**, Naval Architect, William Cramp and Son's Ship and Engine Building Company, and for mail, Riverton, New Jersey.
- ATLEE, WALTER**, Civil Engineer, 6 West Read Street, Baltimore, Maryland.
- ATTERBURY, W. W.**, Brigadier-General, Vice President, Pennsylvania Railroad Company, Broad Street Station, Philadelphia, Pennsylvania.
- ATWATER, RICHARD M., Jr.**, Consulting Mining Engineer, Scarsdale, New York.
- AUSTIN, Dr. LOUIS W.**, U. S. Naval Radio Research Laboratory, Bureau of Standards, Washington, D. C.
- AUSTIN, W. L.**, Vice-Chairman of the Board, The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- AYRES, EUGENE E., Jr.**, Chemical Engineer, Sharples Specialty Company, 23rd and Westmoreland Streets, Philadelphia, Pennsylvania.
- BACHE, DANIEL T.**, Student, 2102 Pine Street, Philadelphia, Pennsylvania.
- BACON, Dr. RAYMOND FOSS**, Chemical Engineer, Chemists Building, 50 East 41st Street, New York City, New York.
- BADENHAUSEN, CARL W.**, Mechanical Engineer, Short Hills, New Jersey.
- BAEKELAND, Dr. L. H.**, Research Chemist, Snug Rock, Harmony Park, Yonkers-on-Hudson, New York.
- BAKER, FRANKLIN, Jr.**, Manufacturer, The Park Lane, 48th and Park Avenue, New York City, New York.
- BAKER, GEORGE FALES**, Physician, 403 Lafayette Building, Philadelphia, Pennsylvania.
- BALCH, ALFRED C.**, Publisher, 227 South 6th Street, Philadelphia, Pennsylvania.
- BALCH, EDWIN S.**, Attorney-at-Law, 1634 Spruce Street, Philadelphia, Pennsylvania.
- BALDWIN, FREDERIC E.** (Retired), 2200 Walnut Street, Philadelphia, Pennsylvania.
- BALLARD, R. H.**, Vice-President and Assistant General Manager, Southern California Edison Company, Edison Building, Los Angeles, California.
- BALLENTINE, WILLIAM I.**, Vice President, Advance Rumely Company, La Porte, Indiana.
- BALLS, WILLIAM H.**, South Philadelphia High School, Broad and Jackson Streets, Philadelphia, Pennsylvania.
- BANCROFT, JOHN**, Manufacturer, Wilmington, Delaware.
- BANCROFT, JOSEPH**, Vice-President and Treasurer, Joseph Bancroft and Sons, Wilmington, Delaware.
- BANNISTER, J. C.**, Lock Box 26, Boston, Massachusetts.
- BANTA, CLIFFORD**, Chief Chemist, Barrett Company, Margaret and Bermuda Streets, Philadelphia, Pennsylvania.

- BARNES, JAMES, Professor of Physics, Bryn Mawr College, Bryn Mawr, Pennsylvania.
 BARNES, JOHN HAMPTON, Attorney-at-Law, Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.
 BARNETT, EDWIN S., Wheat Starch Manufacturer, 7011 Cresheim Road, Mt. Airy, Philadelphia, Pennsylvania.
 BARNHART, G. EDWARD, Aeronautical Engineer, 1547 East Walnut Avenue, Pasadena, California.
 BARR, Major JOHN H., Mechanical Engineer, The Barr-Morse Corporation, Ithaca, New York.
 BARRINGER, DANIEL MOREAU, Geologist and Mining Engineer, 1242 Real Estate Trust Building, Philadelphia, Pennsylvania.
 BARTH, CARL G., Consulting Engineer, 424 Whitney Avenue, New Haven, Connecticut.
 BARTOW, EDWARD, Chemistry Department, State University of Iowa, Iowa City, Iowa.
 BASFORD, G. M., President, Locomotive Feed Water Heater Company, Room 719, 17 East 42nd Street, New York City, New York.
 BASSETT, WILLIAM H., Technical Superintendent, American Brass Company, Waterbury, Connecticut, and for mail, Cheshire, Connecticut.
 BATES, C. W., Electrical Engineer, Philadelphia Electric Company, and for mail, 403 N. Narberth Avenue, Narberth, Pennsylvania.
 BATES, ONWARD, Civil Engineer, 332 South Michigan Avenue, Chicago, Illinois.
 BEACH, CHARLES S., Designer and Machinist, 745 Main Street, Bennington, Vermont.
 BEALE, HORACE A., Jr., President, Parkesburg Iron Company, Parkesburg, Pennsylvania.
 BEALE, LEONARD T., Secretary, John T. Lewis & Brother Company, 705 Lafayette Building, Philadelphia, Pennsylvania.
 BEATH, E. R., Lapidist and Jeweler, 129 South 12th Street, Philadelphia, Pennsylvania.
 BECK, M. A., Vice-President and Chief Engineer, Milwaukee Electric Crane and Manufacturing Company, 294 Greenbush Street, Milwaukee, Wisconsin.
 BECKER, IRWIN A., Pharmacist, in care of Michael Reese Hospital, 2839 Ellis Avenue, Chicago, Illinois.
 BELFIELD, T. BROOM, Manufacturer, 1905 Spring Garden Street, Philadelphia, Pennsylvania.
 BELL, J. SNOWDEN, Attorney-at-Law, Box 0316, City Hall Station, New York City, New York.
 BEMENT, WILLIAM P. (Retired), 743 Real Estate Trust Building, Philadelphia, Pennsylvania.
 BENNETT, C. E., Electrical Engineer, Georgia Railway and Power Company, Atlanta, Georgia.
 BENNETT, FREDERICK M., Mechanical and Electrical Engineer, 2507 Master Street, Philadelphia, Pennsylvania.
 BENZON, GEORGE H., Jr., Mechanical Engineer, 252 Mather Road, Jenkintown, Pennsylvania.
 BERG, ERNST J., Professor of Electrical Engineering, Union College, Schenectady, New York.
 BERG, HOLGER V., Chemical Engineer, Newport, Delaware.
 BERG, P. ESKIL, Electrical Engineer, General Electric Company, Schenectady, New York, and for mail, 14 Lowell Road, Schenectady, New York.
 BERLINER EMILE, Engineer, 1458 Columbia Road, Washington, D. C.
 BERLINER, HERBERT S., Engineer, Compo Company, Limited, 131 18th Avenue, Lachine, Canada.
 BERRESFORD, A. W., care of Mr. Frank S. Low, 5110 Buffalo Avenue, Niagara Falls, New York.
 BIDDLE, CHARLES M., Jr., First Vice-President, Supplee-Biddle Hardware Company, 517 Commerce Street, Philadelphia, Pennsylvania.
 BIDDLE, ELIZABETH C., 400 South 15th Street, Philadelphia, Pennsylvania.
 BIDDLE, JAMES C., Jr., Abbey of Gethsemani, Trappist, Post Office, Kentucky.
 BIDDLE, JAMES G., Importer of Scientific Apparatus, Wallingford, Pennsylvania.
 BIDDLE, ROBERT, President, Biddle-Gaumer Company, 3846-56 Lancaster Avenue, Philadelphia, Pennsylvania.
 BIERBAUM, CHRISTOPHER H., Consulting Engineer, 1011 Mutual Life Building, Buffalo, New York.
 BIGELOW, S. LAWRENCE, Professor of General and Physical Chemistry, University of Michigan, Ann Arbor, Michigan.
 BILGRAM, HUGO, Machinist, 1235 Spring Garden Street, Philadelphia, Pennsylvania.
 BILLINGS, A. W. K., Civil, Mechanical and Electrical Engineer, in care of Brazilian Hydro Electric Company, Limited, Caixa do Correio 2444, Rio de Janeiro, Brazil.
 BILLOW, CLAYTON O., Consulting Engineer, 1431 Jarvis Avenue, Rogers Park, Chicago, Illinois.
 BILYEU, THOMAS, Mechanical Engineer, 697 E. Broadway Street, Portland, Oregon.
 BINDER, RICHARD L., President, K. & B. Company, Special Electrical Supplies, 931 North 8th Street, Philadelphia, Pennsylvania.
 BIRCH, GEORGE W., Jr., Chemist, 19 Fairview Avenue, Highland Park, Delaware County, Pennsylvania.
 BIRKINBINE, CARL PETER, Engineer, Room 800, Commercial Trust Building, Philadelphia, Pennsylvania.
 BLACKBURN, ARTHUR, Grain Merchant, 315 Chamber of Commerce, and for mail, 405 Hollen Road (Cedarcroft), Baltimore, Maryland.
 BLACKBURN, CAROLINE D., Chemist, 7028 Paschall Avenue, Philadelphia, Pennsylvania.
 BLAIR, A. A., Analytical Chemist, 406 Locust Street, Philadelphia, Pennsylvania.
 BLATZ, FREDERICK J., Leather Manufacturer, P. O. Box 967, Wilmington, Delaware.
 BLUM, ARTHUR N., Mechanical Engineer, Delmar-Morris Apartments, Germantown, Philadelphia, Pennsylvania.
 BODINE, SAMUEL T., President, the United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.

- BOEKEL, J., Manufacturer of Metal Goods, 518 Vine Street, Philadelphia, Pennsylvania.
- BOERICKE, FELIX A., (Retired), Bryn Athyn, Pennsylvania.
- BOERICKE, GIDEON, Civil Engineer, Wynnewood, Pennsylvania.
- BOERICKE, JOHN J., Merion, Pennsylvania.
- BOLTON, Dr. ELMER K., Chemist, Jackson Laboratory, Box 525, Wilmington, Delaware.
- BONINE, CHARLES E., Consulting and Designing Engineer, Franklin Trust Building, 20 South 15th Street, Philadelphia, Pennsylvania.
- BOOZ, H. C., Chief Engineer, Berwind-White Coal Mining Company, 1100 Commercial Trust Building, Philadelphia, Pennsylvania.
- BORIE, BEAUVEAU, Jr., Investment Broker, 511 Chestnut Street, Philadelphia, Pennsylvania.
- BORTON, GEORGE W., President and General Manager, Pennsylvania Crusher Company, 1324 Stephen Girard Building, Philadelphia, Pennsylvania.
- BOSTWICK, J. VAUGHAN, St. Davids, Pennsylvania.
- BOURNE, GEORGE L., Vice President, Locomotive Superheater Company, 17 East 42nd Street, New York City, New York.
- BOWEN, SAMUEL B., Manufacturer, 4th Street and Sedgley Avenue, Philadelphia, Pennsylvania.
- BOWER, C. P., Civil Engineer, 11 Eastern Avenue, Wyndmoor, Montgomery County, Pennsylvania.
- BOWER, WILLIAM HENRY, Manufacturing Chemist, 29th Street and Gray's Ferry Road, Philadelphia, Pennsylvania.
- BOYER, MURRAY C., Solicitor of Patents, 829 Stephen Girard Building, 21 South 12th Street, Philadelphia, Pennsylvania.
- BRADBURY, Dr. ROBERT H., Science Teacher, Southern High School, 2100 Shunk Street, Philadelphia, Pennsylvania.
- BRADDOCK-ROGERS, K., 125 West Park Avenue, Haddonfield, New Jersey.
- BRADLEY, A. J., Manufacturer, 101 Beekman Street, New York City, New York.
- BRADY, EDWARD J., Engineering Research, 3101 Passyunk Avenue, Philadelphia, Pennsylvania.
- BREED, GEORGE, Consulting Engineer, 277 Harvey Street, Germantown, Philadelphia, Pennsylvania.
- BREWER, Dr. J. EDWARD, Vice President and Chief Chemist, Southeast Corner 18th and Cherry Streets, Philadelphia, Pennsylvania.
- BREWER, ROBERT WELLESLEY ANTONY, Consulting Engineer, 508 Atlantic Building, Broad and Spruce Streets, Philadelphia, Pennsylvania.
- BRIESEN, FRITZ V., Attorney-at-Law, 25 Broad Street, New York City, New York.
- BRIGHT, JOHN IRWIN, Architect, Devon, Pennsylvania.
- BRINLEY, CHARLES E., President, American Pulley Company, 4200 Wissahickon Avenue, Philadelphia, Pennsylvania.
- BRINTON, CLEMENT STARR, Food Inspection Chemist, 134 South Second Street, Philadelphia, Pennsylvania.
- BRINTON, RUSSELL L., 3700 Kensington Avenue, Philadelphia, Pennsylvania.
- BROCK, JOHN W., Retired Attorney, 511 Bullitt Building, Philadelphia, Pennsylvania.
- BROMLEY, JOSEPH H., Manufacturer, Cheltenham and Wissahickon Avenues, Philadelphia, Pennsylvania.
- BROWN, FRANCIS SHUNK, Lawyer, 1005 Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- BROWN, RICHARD P., President, Brown Instrument Company, Wayne and Windrim Avenues, Philadelphia, Pennsylvania.
- BROWN, T. WISTAR, 3rd, Attorney, 230 Chestnut Street, and for mail, 5920 City Avenue, Philadelphia, Pennsylvania.
- BROWNSTEIN, BENJAMIN, Mechanical Engineer, Elwood City, Pennsylvania.
- BRUNNER, FRANK A., Drawing Materials, 910 Filbert Street, Philadelphia, Pennsylvania.
- BRUNKER, ROBERT J., Banker, 1000 Walnut Street, Philadelphia, Pennsylvania.
- BRUSH, CHARLES F., Electrical Engineer, 3725 Euclid Avenue, Cleveland, Ohio.
- BUCHANAN, CHARLES GORDON, Mechanical Engineer, 167 North Munn Avenue, East Orange, New Jersey.
- BUCK, H. W., Consulting Engineer, 49 Wall Street, New York City, New York.
- BUDD, A. Van WYCK, Berwyn, Prince George County, Maryland.
- BUDD, EDWARD G., Machinist, 502 Westview Street, Germantown, Philadelphia, Pennsylvania.
- BULLOCK, WILLIAM E., Mechanical Engineer, 29 West 39th Street, New York City, New York.
- BUNNELL, STERLING H., Vice-President and Manager, Ash Reclaiming Machinery Corporation, 347 Madison Avenue, New York City, New York.
- BUREAU, E. W., Bronze Founder, S. E. Corner 23rd and Westmoreland Streets, Philadelphia, Pennsylvania.
- BURGESS, WILLIAM J., 940 South 55th Street, Philadelphia, Pennsylvania.
- BURHORN, EDWIN, Engineer and Contractor, 938 Hudson Street, Hoboken, New Jersey.
- BURK, CHARLES A. D., Physical Chemist and Inventor, 401 Santa Rita Apartments, Atlantic City, New Jersey.
- BURLINGAME, LUTHER D., Industrial Superintendent, Brown and Sharpe Manufacturing Company, Providence, Rhode Island.
- BURROUGHS, JOSEPH H., Attorney-at-Law, 612 Bullitt Building, Philadelphia, Pennsylvania.
- BURT, MILO C., Chemist, 636 Water Street, Bridgeport, Connecticut.
- BUSH, S. P., Manufacturer, The Buckeye Steel Castings Company, Columbus, Ohio.
- BUSSER, FRANK S., Attorney-at-Law, 904 Land Title Building, Philadelphia, Pennsylvania.
- BUXTON, GEORGE E., Industrial Engineer, 322 King Street, Pottstown, Pennsylvania.
- BYERS, ISAAC W. (Retired), Iron River, Michigan.

- BYRD, JOHN, Metal Worker, address unknown.
- CABOT, GEORGE E., 60 State Street, Boston, Massachusetts.
- CAIRD, JAMES M., Chemist and Bacteriologist, Proctor's Building, 92 Fourth Street, Troy, New York.
- CALKINS, G. H., Manager, General Electric Company, Tenth Floor, Electric Building, Buffalo, New York.
- CALVERT, HAROLD, Consulting Engineer, Calvert and Barnes, 2114 Sansom Street, Philadelphia, Pennsylvania.
- CAMERON, Dr. FRANK K., Consulting Chemist, 46 Bransford Apartments, Salt Lake City, Utah.
- CANBY, WILLIAM W., Fruit Grower, Grants Pass, Oregon.
- CANFIELD, FREDERICK A., Mining Engineer, Dover, New Jersey.
- CAPLES, MARTIN J., Vice-President, Seaboard Airline Railway Company, and for mail, 701 Stockley Gardens, Norfolk, Virginia.
- CAPP, JOHN A., Mechanical Engineer, 1309 Union Street, Schenectady, New York.
- CAPP, S. BUNKER, Capitalist, P. O. Box 2054, Philadelphia, Pennsylvania.
- CAPPS, W. L., Rear Admiral, U. S. N., Chief Constructor, Bureau of Construction and Repair, Navy Department, Washington, D. C.
- CARTER, EDWARD C., Consulting Engineer, 412 Greenwood Boulevard, Evanston, Illinois.
- CARTY, Brig. General JOHN J., Vice-President and Chief Engineer, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
- CASACOF, CHRISTO, Consulting Engineer, 138 rue de la Tombe-Issoire, Paris, France.
- CASPARI, Dr. CHARLES E., Professor of Chemistry, 2108 Locust Street, St. Louis, Missouri.
- CASSELMAN, WILLIAM S., Attorney-at-Law, Secretary, West Jersey Title and Guarantee Company, and for mail, 317 Penn Street, Camden, New Jersey.
- CATHERWOOD, WILSON, Merchant, 1708 Walnut Street, Philadelphia, Pennsylvania.
- CATON, JOHN J., Consulting Electrical Engineer, 321 Mercer Street, Phillipsburg, New Jersey.
- CHAFFEE, E. LEON, Assistant Professor of Physics, Cruft Laboratory, Cambridge, Massachusetts.
- CHAMBERLAIN, G. E., Engineer, 1650 East William Street, Decatur, Illinois.
- CHAMBERS, Dr. ARTHUR DOUGLAS, Chemical Engineer, E. I. du Pont de Nemours and Company, and for mail, R. F. D. 1, Edgemoor, Delaware.
- CHAMBERS, FRANCIS T., Attorney-at-Law, 605-608 New Stock Exchange Building, 1411 Walnut Street, Philadelphia, Pennsylvania.
- CHAMBERS, J. HOWARD, Chambers Brothers Company, Founders and Machinists, and for mail, 52nd and Media Streets, Philadelphia, Pennsylvania.
- CHANCE, Dr. EDWIN M., Consulting Chemist and Engineer, care of Day and Zimmermann, 1600 Walnut Street, Philadelphia, Pennsylvania.
- CHANCE, Dr. HENRY M., Mining Engineer and Geologist, 839 Drexel Building, Philadelphia, Pennsylvania.
- CHANDLER, CHARLES F., Emeritus Professor of Chemistry, 51 East 54th Street, New York City, New York.
- CHANDLER, T. P., Architect, 249 South 16th Street, Philadelphia, Pennsylvania.
- CHARLTON, RICHARD C., 5017 Griscom Street, Frankford, Philadelphia, Pennsylvania.
- CHESTERMAN, FRANCIS J., Chief Engineer, The Bell Telephone Company, 261 North Broad Street, Philadelphia, Pennsylvania.
- CHRISMAN, CHAS. S., Mechanical Engineer, The United Gas Improvement Company, 435 West Miner Street, West Chester, Pennsylvania.
- CHRISTIANSON, A., Chief Engineer, Standard Steel Car Company, and for mail, P. O. Box 877 Butler, Pennsylvania.
- CHURCH, ARTHUR L., Secretary of The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- CLAGHORN, CLARENCE R., Mining Engineer, 715 Continental Building, Baltimore, Maryland.
- CLAMER, F. J. (Retired), Collegeville, Montgomery County, Pennsylvania.
- CLAMER, G. H., Metallurgist and Chemist, First Vice President and Secretary, The Ajax Metal Company, Frankford Avenue and Richmond Street, Philadelphia, Pennsylvania.
- CLARK, A. WAYNE, Chemist, in care of Johnson and Johnson, New Brunswick, New Jersey.
- CLARK, BEAUVAIS, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, Miss. DARTHELA, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, EDWARD B., Lieut.-Colonel, Publisher, 61 Cedar Street, Chicago, Illinois.
- CLARK, EDWARD L., Engineer, American Motor Body Company, 18th Street and Lehigh Avenue, Philadelphia, Pennsylvania.
- CLARK, E. W., Banker, 321 Chestnut Street, Philadelphia, Pennsylvania.
- CLARK, FRANK SHAW, Mechanical Engineer, Stone and Webster Engineering Corporation, 147 Milk Street, Boston, Massachusetts.
- CLARK, JOSEPH S., Attorney-at-Law, Highland Avenue, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, THEOBALD F., 490 Abington Avenue, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, WALTON, Consulting Engineer, The United Gas Improvement Company, and for mail, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, Mrs. WALTON, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, WALTON, Jr., Attorney-at-Law, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLOUD, JOHN W., Chairman, The Westinghouse Brake and Saxby Signal Company, Limited, 82 York Road, King's Cross, London, N. 1, England.
- CLYMER, EVAN MORGAN, Chief Clerk, Inspector of Hull Material for U. S. Navy, and for mail, 142 East Fishers Avenue, Olney, Philadelphia, Pennsylvania.

- COATES, JESSE, Consulting Engineer, and Metallurgist, 40 Ocean Avenue, Lynn, Massachusetts.
- COCHRAN, C. B., Chemist, State Dairy and Food Commission, and for mail, 514 South High Street, West Chester, Pennsylvania.
- COCKERILL, H. W., Technical Clerk, 19 Rata Road, Hataitai, Wellington, New Zealand.
- COFFIN, C. A., Chairman of the Board, General Electric Company, 120 Broadway, New York City, New York.
- COLLINGWOOD, J. REED, Buyer, Fels and Company, and for mail, 510 South 41st Street, Philadelphia, Pennsylvania.
- COLLINS, CHARLES RUSSELL, Consulting Engineer, 805 Lowman Building, Seattle, Washington.
- COLLINS, HENRY H., Manufacturer, 226 Columbia Avenue, Philadelphia, Pennsylvania.
- COLLOM, SAMUEL H., President, Pennsylvania Flexible Metallic Tubing Company, 505 Abbott Building, Philadelphia, Pennsylvania.
- COLVIN, CHARLES H., Mechanical Engineer, 61 Poplar Street, Brooklyn, New York.
- COLVIN, FRED H., Editor, *American Machinist*, Tenth Avenue at 36th Street, New York City, New York, and for mail, 46 Lenox Avenue, East Orange, New Jersey.
- COLVIN, HENRY FRED, 2nd, 754 Lexington Avenue, Brooklyn, New York.
- COLWELL, ROBERT C., Professor of Physics, Geneva College, Beaver Falls, Pennsylvania, and for mail, 332 Demain Avenue, Morgantown, West Virginia.
- COMER, HARRIS, Chemist, Manufacturer of Scientific Apparatus, 622 South Washington Square, Philadelphia, Pennsylvania, and for mail, 431 State Road, Cynwyd, Pennsylvania.
- COMEY, Dr. ARTHUR M., Chemist, 380 Mt. Auburn Street, Cambridge, Massachusetts.
- CONAWAY, JOHN F., Secretary and Treasurer, National Umbrella Frame Company, 30th and Thompson Streets, Philadelphia, Pennsylvania.
- CONDUCT, G. H., Consulting Mechanical and Electrical Engineer, 922 Central Avenue, Plainfield, New Jersey.
- CONN, CHARLES F., President, Giant Portland Cement Company, Pennsylvania Building, Philadelphia, Pennsylvania.
- CONNABLE, FRANK L., Vice-President, E. I. du Pont de Nemours and Company, 622 du Pont Building, Wilmington, Delaware.
- CONVERSE, WILLIAM A., Chemical Engineer, Dearborn Chemical Company, McCormick Building, Chicago, Illinois.
- COOKE, MORRIS LLEWELLYN, Consulting Engineer in Management, Acting Director, The Utilities Bureau, 1009 Finance Building, and for mail, 401 West Walnut Lane, Germantown, Philadelphia, Pennsylvania.
- COOLEY, MORTIMER E., Dean, Colleges of Engineering and Architecture, Engineering Building, University of Michigan, Ann Arbor, Michigan.
- COOPER, HENRY, Manufacturer of Olive Oil, 403 East Valerio Street, Santa Barbara, California.
- COPE, THOMAS D., Assistant Professor of Physics, Randal Morgan Laboratory of Physics, University of Pennsylvania, Philadelphia, Pennsylvania.
- COPPAGE, BENJAMIN DENVER, Production Engineer, Levgor Structural Company, New York City, and for mail, 2402 Willard Street, Wilmington, Delaware.
- COPPAGE, GEORGE L., Production Manager, The Pusey and Jones Company, Wilmington, Delaware.
- CORNELIUS, CLARENCE E., Salesman, 162 West Coulter Street, Germantown, Philadelphia, Pennsylvania.
- CORNELIUS, JOHN C., Jr., Architect, 420 West Price Street, Germantown, Philadelphia, Pennsylvania.
- CORNELIUS, JUSTICE C., Civil Engineer, 821 Lehigh Street, Easton Pennsylvania.
- COTTRELL, JAMES W., Dealer in Automobiles, P. O. Box 302, Hammonton, New Jersey.
- COWAN, WILLIAM ARTHUR, Assistant Chief Chemist, National Lead Company, 129 York Street, Brooklyn, New York.
- COWLES, ALFRED H., President, Electric Smelting and Aluminum Company, Sewaren, New Jersey.
- COX, J. D., President, Cleveland Twist Drill Company, Cleveland, Ohio.
- COX, JOHN L., Mechanical Engineer, 12 Summit Street, Chestnut Hill, Philadelphia, Pennsylvania.
- COX, WALTER, President, Pennsylvania Wire Glass Company, Pennsylvania Building, Philadelphia, Pennsylvania.
- COXE, ALEXANDER BROWN, Agriculturist, Paoli, Pennsylvania.
- COYLE, GEORGE L., S. J., Professor of Organic Chemistry, Georgetown University, Washington, D. C.
- CRAGO, WILLIAM H., Civil Engineer, in care of Fajardo Sugar Company, Fajardo, Porto Rico.
- CRAIG, ROBERT, Consulting Engineer, 907 Schwind Building, Dayton, Ohio.
- CRAMP, FRANCIS L., Assistant to President, Wm. Cramp & Sons, Ship and Engine Building Company, Philadelphia, Pennsylvania.
- CRAMPTON, GEORGE S., Physician, 1819 Walnut Street, Philadelphia, Pennsylvania.
- CRAWFORD, D. F., General Manager, Pennsylvania Lines West of Pittsburgh, 5243 Ellsworth Avenue, Pittsburgh, Pennsylvania.
- CREIGHTON, H. JERMAIN, Associate Professor of Chemistry, Swarthmore College, Swarthmore, Pennsylvania.
- CRENSHAW, Dr. JAMES L., Professor of Physical Chemistry, Bryn Mawr, Pennsylvania.
- CRICHTON, ANDREW B., U. S. Bank Building, Johnstown, Pennsylvania.
- CRISFIELD, J. A. P., Mechanical Engineer, Savannah Gas Company, Savannah, Georgia.
- CROASDALE, JOHN P., Attorney-at-Law, 1011 Chestnut Street, Philadelphia, Pennsylvania.
- CROOK, ALFRED, Vice-President and General Manager, Philadelphia Roll and Machine Company, 25th Street and Washington Avenue, Philadelphia, Pennsylvania.

- CROWELL, WALTER S., Chemical Engineer, Oak Lane, Philadelphia, Pennsylvania.
- CULLEN, GEORGE S., Insurance, 4504 Springfield Avenue, Philadelphia, Pennsylvania.
- CUMMINGS, J. H., President, John B. Stetson Company, Philadelphia, Pennsylvania.
- CUNNINGHAM, J. L., Superintendent of Motive Power, Pennsylvania Railroad Company
Pittsburgh, Pennsylvania.
- CURTIS, CYRUS H. K., Curtis Publishing Building, Philadelphia, Pennsylvania.
- CURTISS, ELLIOTT, President and Treasurer, The United States Metallic Packing Company,
429 North 13th Street, Philadelphia, Pennsylvania.
- CURWEN, SAMUEL M., President, J. G. Brill Company, and for mail, Haverford, Penn
sylvania.
- CUSHMAN, Dr. ALLERTON S., Director, The Institute of Industrial Research, 2201 New
York Avenue, N. W., Washington, D. C.
- DACOSTA, J. CHALMERS, 3rd, Mechanical Engineer, Phoenix Mutual Life Insurance
Company, 603 Finance Building, Philadelphia, Pennsylvania.
- DAILY, FRANCIS X., Engineer, The Bell Telephone Company of Pennsylvania, and for
mail, 109 St. Pauls Road, Ardmore, Pennsylvania.
- DANNENBAUM, HERMAN N., Manufacturer, Vice-President, National Ammonia Company,
Frankford, Philadelphia, Pennsylvania.
- DARROW, KARL K., Physicist, 463 West Street, New York City, New York, and for mail,
610 West 111th Street, New York City, New York.
- DASHIELL, BENJ. J., Consulting Engineer, Dunkirk P. O. Calvert County, Maryland.
- DASHIELL, P. T., Assistant Engineer of Works, The United Gas Improvement Company,
Broad and Arch Streets, Philadelphia, Pennsylvania.
- DAVIDHEISER, LEE, Professor of Chemistry, Millersville Normal School, Millersville,
Pennsylvania.
- DAVIDS, R. W., Consulting Electrical Engineer, Merion Station, Pennsylvania.
- DAVIDSON, GEORGE M., Chemist and Engineer of Tests, C. & N. W. R. R. Company,
Chicago, Illinois.
- DAVIS, CARLETON E., Civil Engineer, Indianapolis Water Company, P. O. Box 855,
Indianapolis, Indiana.
- DAVIS, CHARLES HENRY, President and Trustee, Bass River, Cape Cod, Massachusetts.
- DAVIS, ERNEST H., Manager of Street Railways and Electric Light Plants, 901 Vine Avenue,
Williamsport, Pennsylvania.
- DAWES, JAMES H., General Contractor, 1310 Arch Street, Philadelphia, Pennsylvania.
- DAWSON, WILFRED THOMAS, Professor of Physiology, 2101 North College Avenue,
Philadelphia, Pennsylvania.
- DAY, Dr. ARTHUR L., Director Geophysical Laboratory, Carnegie Institution, Wash-
ington, D. C.
- DAY, CHARLES, President, Day and Zimmermann, Engineers, 1600 Walnut Street, Phila-
delphia, Pennsylvania.
- DAY, DAVID T., Petroleum Expert, 715 19th Street, N. W., Washington, D. C.
- DE GRAAFF, ANTONIUS, Chemical Engineer, Philips' Glowlampworks, Limited, Eindhoven,
Holland.
- DELANO, FREDERIC A., Receiver, 288 Treasury Building, Washington, D. C.
- DELLENBAUGH, FREDERICK S., Jr., Electrical Engineer, Massachusetts Institute of
Technology, and for mail, 91 Spooner Road, Chestnut Hill, Massachusetts.
- DEMPSEY, W. L., Engineer and Attorney-at-Law, Thum Engineering Company, 406 Market
Street, St. Louis, Missouri.
- DENIG, FRED., Combustion Engineer, The Koppers Company, Union Arcade, Pittsburgh,
Pennsylvania.
- DESHONG, HOWARD T., Superintendent, Philadelphia Electric Company, and for mail,
9 Lansdowne Avenue, Lansdowne, Pennsylvania.
- DETWILER, J. G., Chemist, Room 913, The Texas Company, Houston, Texas.
- DICKERSON, EDWARD N., Attorney-at-Law, 41 Park Row, New York City, New York.
- DIDIER, PAUL, Principal Assistant Engineer, Baltimore and Ohio Railroad Company, Cones-
toga Building, Wood and Water Streets, Pittsburgh, Pennsylvania.
- DILLENBECK, CLARK, Civil Engineer, 522 Reading Terminal, Philadelphia, Pennsylvania.
- D'INVILLIERS, EDWARD VINCENT, Geologist and Mining Engineer, 121 North Broad
Street, Philadelphia, Pennsylvania.
- DISSTON, WILLIAM D., Manufacturer, in care of Henry Disston & Sons, Tacony, Phila-
delphia, Pennsylvania.
- DIVEN, J. M., Superintendent of Water Works, Troy, New York.
- DOANE, SAMUEL E., Chief Engineer National Lamp Works of the General Electric Company,
Nela Park, Cleveland, Ohio.
- DOBSON, WILLIAM ALEXANDER, Naval Architect, Cramp Shipyard, Philadelphia, Penn-
sylvania, and for mail, 5918 Wayne Avenue, Philadelphia, Pennsylvania.
- DODGE, KERN, Consulting Engineer, Morris Building, Philadelphia, Pennsylvania.
- DOHERTY, HENRY L., President, Cities Service Company, 60 Wall Street, New York City,
New York.
- DOLAN, THOMAS J., Chestnutwold Farm, Devon, Pennsylvania.
- DONALD, WILLIAM, Chemist and Assayer, Bloomingdale, New Jersey.
- DONOHUE, JOHN P., Coal Operator, Coulter Building, Greensburg, Pennsylvania.
- DORNER, WILLIAM F., 25th Ward Gas Works, Richmond and Tioga Streets, Philadelphia,
Pennsylvania.
- DORR, JOHN V. N., Metallurgical and Chemical Engineer, President, The Dorr Company,
The Architects Building, 101 Park Avenue, New York City, New York.
- DOUGHERTY, CHARLES JAMES, Consulting Engineer, Room 719, 149 Broadway, New
York City, New York.
- DOUREDOURE, BERNARD L., Student, 103 Walnut Street, Philadelphia, Pennsylvania.
- DOUTHIRT, WALSTEIN F., 1752 Equitable Building, New York City, New York.

- DOW, HERBERT H.**, General Manager, The Dow Chemical Company, Midland, Michigan.
- DOYLE, WILLIAM J.**, Contractor and Builder, 1519 Sansom Street, Philadelphia, Pennsylvania.
- DRAKE, LEWIS MARVIN**, Experimental Scientist, West Fairview Avenue, Daytona, Florida.
- DREXEL, JOHN R.**, 112 Drexel Building, Philadelphia, Pennsylvania.
- DUBILIER, WILLIAM**, President, Dubilier Condenser and Radio Corporation, 48 West Fourth Street, New York City, New York.
- DUBOSQUE, F. L.**, Superintendent of Floating Equipment, Pennsylvania Station, New York City, New York.
- DUNCAN, J. S.**, Inventor, 901 West Van Buren Street, Chicago, Illinois.
- DUNCAN, THOMAS**, President, Duncan Electric Manufacturing Company, Lafayette, Indiana.
- DUNDORE, CHARLES R.**, 8205 Seminole Avenue, Philadelphia, Pennsylvania.
- DUNN, GANO**, President, J. G. White Engineering Corporation, and for mail, 20 Washington Square, New York City, New York.
- DUNNINGTON, F. P.**, Professor of Chemistry, University of Virginia, Virginia.
- Du PONT, IRENEE**, Vice-President, E. I. du Pont de Nemours and Company, Wilmington, Delaware.
- Du PONT, PIERRE S.**, President, E. I. du Pont de Nemours and Company, Wilmington, Delaware.
- DURBAN, THOMAS E.**, General Manager, Erie City Iron Works, Erie, Pennsylvania.
- D'UTASSY, GEO.**, Publisher, Cedarhurst, Long Island, New York.
- DYER, FRANK LEWIS**, Mechanical Expert, 217 Broadway, New York City, New York.
- EARNSHAW, WARNER G.**, 128 South 19th Street, Philadelphia, Pennsylvania.
- EASON, JOHN STUART**, Room 950 Transportation Building, 608 South Dearborn Street, Chicago, Illinois.
- EAVERSON, HOWARD N.**, Engineer, 4311 Bayard Street, Pittsburgh, Pennsylvania.
- EBERLE, E. G.**, Editor, Journal of the American Pharmaceutical Association, Room 253, Bourse Building, Philadelphia, Pennsylvania.
- ECKERT, SAMUEL B.**, Oil Refiner, Finance Building, 1428 South Penn Square, Philadelphia, Pennsylvania.
- ECKHARDT, E. A.**, Marland Oil Company, Ponca City, Oklahoma.
- EDGAR, C. L.**, President and General Manager, Edison Electric Illuminating Company, 70 State Street, Boston, Massachusetts.
- EDISON, THOMAS A.**, Inventor, Orange, New Jersey.
- EGLIN, W. C. L.**, Vice-President and Chief Engineer, Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- EGLOFF, Dr. GUSTAV**, Petroleum Technologist, The Universal Oil Product Company, Strass Building, Chicago, Illinois.
- EHRENFELD, Dr. FREDERICK**, College Hall, University of Pennsylvania, Philadelphia, Pennsylvania.
- EHRET, CORNELIUS D.**, Patent Lawyer, 6911 Clearview Street, Mount Airy, Philadelphia, Pennsylvania.
- ELCOCK, JOHN J.**, Attorney-at-Law, 1135 Commercial Trust Building, Philadelphia, Pennsylvania.
- ELDRED, Dr. BYRON E.**, 41 East 42nd Street, New York City, New York.
- ELKINS, GEORGE W.**, Vice-President of Companies, Land Title Building, Philadelphia, Pennsylvania.
- ELKINTON, HOWARD W.**, Assistant Manager, Foreign Department, Philadelphia Quartz Company, 121 South Third Street, Philadelphia, Pennsylvania.
- ELKINTON, THOMAS W.**, Philadelphia Quartz Company, 121 South Third Street, Philadelphia, Pennsylvania.
- ELLIOT, EDWIN**, Foundry Superintendent, 403 West Price Street, Germantown, Philadelphia, Pennsylvania.
- ELLIS, CARLETON**, Research Chemist and Chemical Engineer, 92 Greenwood Avenue, Montclair, New Jersey.
- ELLIS, HALCOLM**, Mechanical Engineer, 16 Lawrence Street, Newark, New Jersey.
- ELLIS, WILLIAM GODEY**, Engineer, 20 South 15th Street, Philadelphia, Pennsylvania, and for mail, 4549 Morris Street, Germantown, Philadelphia, Pennsylvania.
- ELMENDORF, ARMIN**, Consulting Engineer, 645 North Michigan Avenue, Chicago, Illinois.
- ELVERSON, JAMES, Jr.**, Publisher, The Philadelphia Inquirer, Philadelphia, Pennsylvania.
- EMERICK, J. M.**, Office Manager, 1501 Commonwealth Building, Philadelphia, Pennsylvania.
- EMERSON, GEORGE H.**, Chief of Motive Power and Equipment, Baltimore and Ohio Railroad, Baltimore, Maryland.
- EMERSON, HARRINGTON**, Efficiency Engineer, Room 1522, Hudson Terminal Building, 30 Church Street, New York City, New York.
- ENGELHARD, CHARLES**, Importer, Hudson Terminal Building, 30 Church Street, New York City, New York.
- EPPELSHEIMER, DANIEL, Jr.**, Chief Engineer, 419 Broadway, Middletown, Ohio.
- ERHART, WILLIAM H.**, Manufacturing Chemist, 81 Maiden Lane, New York City, New York.
- ERNE, ALFRED**, Clerk, William H. Horstmann Company, and for mail, 20 East Athens Avenue, Ardmore, Pennsylvania.
- ETTENGER, R. L.**, Consulting Mechanical Engineer, Southern Railway, 1300 Pennsylvania Avenue, Washington, D. C.
- EVANS, OWEN BROOKE**, Mechanical Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- EVANS, POWELL**, 2035 Washington Avenue, Philadelphia, Pennsylvania.
- EVANS, WAYNE S.**, Manufacturer of Metal Goods, 4623 Paul Street, Frankford, Philadelphia, Pennsylvania.

- EVE, A. S., Professor of Physics, McGill University, Montreal, Canada.
- EYANSON, J. EDWARD, 207 South 10th Street, Philadelphia, Pennsylvania.
- FABRY, CHARLES, Professor of Physics, University of Paris, 1 Rue Victor-Cousin, Paris (Se) France.
- FAIRCHILD, S. E., Jr., Civil and Mining Engineer, Land Title Building, Philadelphia, Pennsylvania.
- FAIRCHILD, SHERMAN M., Engineer, Fairchild Aerial Camera Corporation, 136 West 52nd Street, New York City, New York, and for mail, 30 East 55th Street, New York City, New York.
- FALKENAU, ARTHUR, Industrial Engineer, 911 Park Avenue, New York City, New York.
- FARRAND, DUDLEY, Assistant to the President, Public Service Corporation of New Jersey, 80 Park Place, Newark, New Jersey.
- FAUGHT, Dr. L. ASHLEY, Professor of Operative Dentistry, Philadelphia Dental College, 18th and Buttonwood Streets, Philadelphia, Pennsylvania.
- FEARING, FREDERICK C., Consulting Engineer, 2112 Delancey Place, Philadelphia, Pennsylvania.
- FEARON, CHARLES, Banker, 333 Chestnut Street, Philadelphia, Pennsylvania.
- FEBIGER, C. C., 3421 Powelton Avenue, Philadelphia, Pennsylvania.
- FELLOWS, E. R., President and General Manager, The Fellows Gear Shaper Company, Springfield, Vermont.
- FELS, MAURICE, 4305 Spruce Street, Philadelphia, Pennsylvania.
- FELS, SAMUEL S., Soap Manufacturer, 39th and Walnut Streets, Philadelphia, Pennsylvania.
- FELTON, EDGAR CONWAY, President, Pennsylvania Steel Company, and for mail, Haverford, Pennsylvania.
- FELTON, SAMUEL M., President, Chicago Great Western Railway, 1121 Peoples Gas Building, Chicago, Illinois.
- FERGUSON, JOHN, Electrical Engineer, 506 Guaranty Building, Indianapolis, Indiana.
- FERGUSON, LOUIS A., Vice-President and Electrical Engineer, Commonwealth Edison Company, Box 767, 72 West Adams Street, Chicago, Illinois.
- FERGUSON, WALTER B., 426 School Lane, Germantown, Philadelphia, Pennsylvania.
- FERNALD, ROBERT HEYWOOD, Whitney Professor of Dynamical Engineering, Mechanical Engineering Department, University of Pennsylvania, Philadelphia, Pennsylvania.
- FERNANDEZ, GUY D., Electrical Engineer, Haddon Heights, New Jersey.
- FERREE, Dr. C. E., Teacher, Bryn Mawr College, Bryn Mawr, Pennsylvania.
- FERRIE, General G., Inspecteur des Services de la Telegraphie Militaire et des Transmissions, 51 bis, Boulevard LaTour-Maubourg, Paris, France.
- FINCH, WILLIAM G. H., Radio Editor and Engineer, Box 910, City Hall Station, New York City, New York.
- FINKBINER, E. W., Representative, E. F. Houghton Company, and for mail, 207 Market Street, Newark, New Jersey.
- FINLEY, W. H., President C. & N. W. Railway Company, and for mail, 412 N. Washington Street, Wheaton, Illinois.
- FISHER, E. C., Vice-President and General Manager, The Wilkes Boiler Company, and for mail, 308 North Jefferson Avenue, Saginaw, Michigan.
- FISHER, THOMAS, General Manager, Berwind White Coal Mining Company, 1100 Commercial Trust Building, Philadelphia, Pennsylvania.
- FITTS, JAMES LOGAN, Mechanical Engineer, in care of Warren Webster and Company, 17th and Federal Streets, Camden, New Jersey.
- FITZ, E. M., Electrical Engineer, in care of Pennsylvania Railroad System, Syndicate Trust Building, St. Louis, Missouri.
- FITZGERALD, FRANCIS A. J., Consulting Engineer and President, The Fitzgerald Laboratories, Niagara Falls, New York.
- FITZMAURICE, WILLIAM J., Jr., Civil Engineer, 747 Marlyn Road, Philadelphia, Pennsylvania.
- FLANAGAN, CHARLES L., Insurance, Riverton, New Jersey.
- FLANAGAN, LOUIS A., Riverton, New Jersey.
- FLANDERS, RALPH E., Manager, Jones and Lamson Machine Company, and for mail, 41 Pleasant Street, Springfield, Vermont.
- FLEISHER, B. W., Manufacturer, 2301 Green Street, Philadelphia, Pennsylvania.
- FLEMING, FRANCIS P., Attorney-at-Law, 301 Heard Building, Jacksonville, Florida.
- FLETCHER, W. E., Technical Director, Atlas Powder Company, Wilmington, Delaware, and for mail, 4609 Osage Avenue, Philadelphia, Pennsylvania.
- FOOTE, ARTHUR DE WINT, Civil Engineer, North Star Mines, Grass Valley, California.
- FORBES, GEORGE, Professor of Electrical Engineering, No. 11 Little College Street, Westminster, S. W., London, England.
- FORD, BRUCE, Vice-President, Electric Storage Battery Company, 19th Street and Allegheny Avenue, Philadelphia, Pennsylvania.
- FORD, TERENCE J., Assistant Inspector of Ordnance U. S. Navy, and for mail, 847 E. Fourth Street, Bethlehem, Pennsylvania.
- FORREST, CHARLES N., 175 Elm Avenue, Rahway, New Jersey.
- FORSTALL, WALTON, Gas Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- FORTIER, MATTHEW L., Professor of Philosophy, College of the Holy Cross, Worcester, Massachusetts.
- FRANCIS, ISAAC H., Consulting Mechanical and Electrical Engineer, Otis Building, Philadelphia, Pennsylvania.
- FRANK, EDWIN, Mechanical Engineer, 1015 Shepard Avenue, Milwaukee, Wisconsin.
- FRANKLIN, BENJAMIN, Civil and Consulting Engineer, 906-7 Crozer Building, Philadelphia, Pennsylvania.

- FRAZIER, GEORGE H.**, Banker, P. O. Box 1630, Philadelphia, Pennsylvania.
FRAZIER, W. W., Jr., Sugar Refiner, Lock Box 1630, Philadelphia, Pennsylvania.
FREEMAN, HAROLD A. (Retired), St. Davids, Pennsylvania.
FREEMAN, W. W., President, The Union Gas and Electric Company, 4th and Plum Streets, Cincinnati, Ohio.
FRENCH, HOWARD B., Manufacturer, 410 Callowhill Street, Philadelphia, Pennsylvania.
FRERICHS, Dr. F. W., Vice-President, Herf and Frerichs Chemical Company, St. Louis, Missouri.
FRETZ, E. S., Manufacturer, The Light Manufacturing and Foundry Company, Pottstown, Pennsylvania.
FRIES, HAROLD H., Manufacturing Chemist, 92 Reade Street, New York City, New York.
FRY, ANN W., 6433 Jefferson Street, Germantown, Philadelphia, Pennsylvania.
FRYER, GEORGE G., Mechanical Engineer, 203 Onondaga Avenue, Syracuse, New York.
FUGUET, HOWARD, 560 Bullitt Building, 121-141 South 4th Street, Philadelphia, Pennsylvania.
FULLER, GEORGE W., Consulting Engineer, 170 Broadway, New York City, New York.
FULWEILER, W. H., Engineer, United Gas Improvement Company, 319 Arch Street, Philadelphia, Pennsylvania.
FUNK, K. E., Electrical Engineer, 930 Wynnewood Road, Philadelphia, Pennsylvania.
FURNESS, GEORGE W., Millville, New Jersey.
FURNESS, HORACE HOWARD, Jr., Writer, 701 Stephen Girard Building, Philadelphia, Pennsylvania.
FURNESS, RADCLIFFE, Engineer of Research, Midvale Steel Company, 4300 Wissahickon Avenue, Philadelphia, Pennsylvania.
GAGE, Dr. HENRY PHELPS, Physicist, Chief, Optical Division, Corning Glass Works, and for mail, 212 Chemung Street, Corning, New York.
GALLOWAY, C. D., Mechanical Engineer, Electric Storage Battery Company, and for mail, 8409 Anderson Street, Chestnut Hill, Philadelphia, Pennsylvania.
GARDNER, HENRY A., Chemical Engineer, Assistant Director, Institute of Industrial Research, 2201 New York Avenue, Washington, D. C.
GARMAN, FRANK R., Electrical Engineer, 416 Seventh Avenue, Pittsburgh, Pennsylvania.
GARRELS, W. L., Consulting Engineer (Kirkwood Route 13), Mason and Manchester Roads, St. Louis County, Missouri.
GARRIGUES, F. H., Life Insurance, 6806 N. 11th Street, Philadelphia, Pennsylvania.
GARRISON, F. LYNWOOD, Mining Engineer, 1019 Clinton Street, Philadelphia, Pennsylvania.
GARTLEY, WILLIAM H., Gas Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
GAZZAM, JOSEPH M., Retired Lawyer, 265 South 19th Street, Philadelphia, Pennsylvania.
GERHARD, Dr. ARTHUR HOWELL, Manufacturer and Instructor in Medicine, 1615 North Delaware Avenue, Philadelphia, Pennsylvania.
GESELL, W. H., Chemical Engineer and Manager, Lehn and Fink, Incorporated, Bloomfield, New Jersey, and for mail, 235 Christopher Street, Montclair, New Jersey.
GEST, WILLIAM P., President, Fidelity Trust Company, 327 Chestnut Street, Philadelphia, Pennsylvania.
GETMAN, Dr. FREDERICK H., Chemist, Hillside Laboratory, Stamford, Connecticut.
GFROER, A. H., Engineer, The Automatic Transportation Company, 2933-65 Main Street, Buffalo, New York.
GHERARDI, BANCROFT, Engineer of Plant, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
GIBBS, A. E., Chemist, Pennsylvania Salt Manufacturing Company, Widener Building, Philadelphia, Pennsylvania.
GIBBS, E. L., Inspector, Interstate Commerce Commission, and for mail, 2004 Herschell Street, Jacksonville, Florida.
GIBBS, WEBB L., Lubricating Engineer, 7734 South Shore Drive, Chicago, Illinois.
GIBSON, HENRY CLAY, Treasurer, Bank of North America and Trust Company, Philadelphia, Pennsylvania, and for mail, Jenkintown, Pennsylvania.
GIBSON, J. J., Vice-President, Westinghouse Commercial Investment Company, 150 Broadway, New York City, New York.
GILCHRIST, JOHN F., Vice-President, Commonwealth Edison Company, Edison Building, Chicago, Illinois.
GILL, JOHN D., Chemical Engineer, Atlantic Refining Company, 260 South Broad Street, Philadelphia, Pennsylvania.
GILES, IRVIN KLINE, Atlantic Refining Company, Philadelphia, Pennsylvania.
GILPIN, FRANCIS H., Gas Engineer, 22 Edgemont Avenue, Summit, New Jersey.
GITTLESON, FRANK, Violinist, 1017 Spruce Street, Philadelphia, Pennsylvania.
GLENDINNING, ROBERT E., Banker, 400 Chestnut Street, Philadelphia, Pennsylvania.
GLOVER, ROLFE E., Jr., Chemist, 2435 West 18th Street, Wilmington, Delaware.
GOETZENBERGER, RALPH LEON, Electrical Engineer, Frankford Arsenal, Philadelphia, Pennsylvania.
GOHEEN, J. P., Secretary, Brown Instrument Company, Wayne Junction, Philadelphia, Pennsylvania.
GOLDBAUM, JACOBS, S., Research Chemist, 4234 Spruce Street, Philadelphia, Pennsylvania.
GOLDSCHMIDT, V., Professor, Heidelberg University, and for mail, Gaisberg Strasse 9, Heidelberg, Germany.
GOLDSMITH, EDWARD, Retired Chemist, 658 North 10th Street, Philadelphia, Pennsylvania.
GOLDSMITH, EDWIN M., Manufacturer, Friedberger-Aaron Manufacturing Company, Logan Station, Philadelphia, Pennsylvania.
GOMBERG, MOSES, Professor of Chemistry, 712 Onondago Street, Ann Arbor, Michigan.

- GOODSPEED, ARTHUR W.**, Professor of Physics, University of Pennsylvania, Philadelphia, Pennsylvania.
- GOODWIN, HAROLD, Jr.**, Electrical Engineer, Belfield and Lindley Avenues, Philadelphia, Pennsylvania.
- GORDON, HUGH S.**, Mining Engineer, 10 Nevill Court, London, England.
- GRAFTON, E. H.**, Chief Chemist, Quaker City Rubber Company, Wissinoming, Philadelphia, Pennsylvania.
- GRAHAM, WALTER F.**, Metallurgist, Curtis Bay Copper and Iron Works, Curtis Bay, Baltimore, Maryland.
- GRANBERRY, J. H.**, Civil Engineer, American Can Company, 234 West 21st Street, New York City, New York.
- GRAVELL, J. H.**, President, American Chemical Paint Company, Ambler, Pennsylvania.
- GREEN, GEORGE ROSS**, Electrical Engineer, Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- GREENE, ARTHUR M., Jr.**, Professor of Mechanical Engineering, Princeton University, Princeton, New Jersey.
- GREENE, JOSEPH F.**, Chemical Engineer, Kimble Glass Company, Vineland, New Jersey.
- GREENWOOD, RICHARD**, Acting Superintendent, 1212 Allengrove Street, Frankford, Philadelphia, Pennsylvania.
- GREENWOOD, TALMA TEMPLE**, Research Engineer and Patent Solicitor, 40 Court Street Boston, Massachusetts, and for mail, East Templeton, Massachusetts.
- GREVEMEYER, GEORGE A.**, 122 South 13th Street, Philadelphia, Pennsylvania.
- GRIBBEL, JOHN**, Gas Meter Manufacturer, 1513 Race Street, Philadelphia, Pennsylvania.
- GRIBBEL, W. GRIFFIN**, Gas Meter Manufacturer, 1513 Race Street, Philadelphia, Pennsylvania.
- GRIEST, Major THOMAS H.**, Civil Engineer, The Bell Telephone Company of Pennsylvania, 261 North Broad Street, Philadelphia, Pennsylvania.
- GRIFFIN, FRANK H.**, Chief Chemist, Viscose Company, Marcus Hook, Pennsylvania.
- GRIFFITH, W. O.**, 500 East Evergreen Avenue, Chestnut Hill, Philadelphia, Pennsylvania.
- GRISSINGER, ELWOOD**, Consulting Electrical and Mechanical Engineer, 293 Lexington Avenue, Buffalo, New York.
- GRISWOLD, ROBERT G.**, Director of Research, Henry L. Doherty & Company, 60 Wall Street, New York City, New York.
- GROSS, Dr. A. S.**, Dental Surgeon, 508½ Main Street, Newton, Kansas.
- GUBELMAN, FREDERICK J.**, President, The Regina Company, and for mail, Woodland Avenue, Englewood, New Jersey.
- GUCKER, F. T.**, Civil Engineer and Contractor, 1450 Real Estate Trust Building, Philadelphia, Pennsylvania.
- GUDEMAN, Dr. EDWARD**, Consulting Scientific Expert, 903 Postal Telegraph Building, Chicago, Illinois.
- GUTHRIE, BAYARD, R. F. D. No. 2**, Ocean Springs, Mississippi.
- HAGAR, WALTER F., Jr.**, Manufacturer, The Hagar Company, Ambler, Pennsylvania.
- HAIGIS, CARLETON D.**, Research Physicist, Victor Talking Machine Company, Camden, New Jersey.
- HAINES, CASPETER WISTAR**, Civil Engineer, 6026 Germantown Avenue, Philadelphia, Pennsylvania.
- HAINES, ROBERT B., Jr.**, Manufacturer of Rolling Mill Gauges and Haines' Automatic Micrometer, 156 West School Lane, Germantown, Philadelphia, Pennsylvania.
- HAINES, WILLIAM A.**, Manufacturer of Fancy Leather Goods, 238 Allen Lane, Mt. Airy, Philadelphia, Pennsylvania.
- HALE, HENRY S.**, Address unknown.
- HALL, C. A.**, Chemical Engineer, 7951 Winston Road, Chestnut Hill, Philadelphia, Pennsylvania.
- HALL, GEORGE R.**, 311 Finance Building, Philadelphia, Pennsylvania.
- HALL, R. T.**, Rear Admiral, U. S. N., P. O. Box 228, Wynnewood, Pennsylvania.
- HALLBERG, JOSEF HENRIK**, Electrical Expert, 445 Riverside Drive, New York City, New York.
- HALSEY, WILLIAM B.**, Electrical Engineer, 27 Fairview Place, corner Church Avenue, Brooklyn, New York.
- HAMMER, EDWIN W.**, Consulting Engineer, 55 John Street, New York City, New York.
- HAMMER, WILLIAM J.**, Consulting Electrical Engineer, Hotel Earle, 103 Waverly Place, New York City, New York.
- HAMMOND, J. M.**, 14 East Abington Avenue, Chestnut Hill, Philadelphia, Pennsylvania.
- HANTHORN, JOSEPH R.**, Mechanical Engineer, 4135 Girard Avenue, Philadelphia, Pennsylvania.
- HARRISON, ALFRED C.**, Retired Sugar Refiner, 517 Drexel Building, Philadelphia, Pennsylvania.
- HARRISON, Dr. CHARLES C. (Retired)**, 400 Chestnut Street, Philadelphia, Pennsylvania.
- HARRISON, GEORGE L. (Retired)**, 1704 Locust Street, Philadelphia, Pennsylvania.
- HARRISON, J. K. M.**, Engineer, Harrison and Company, Land Title Building, Philadelphia, Pennsylvania.
- HARRISON, MITCHELL**, Financier, Nokesville, Virginia.
- HARRISON, THOMAS RANDOLPH**, Research Manager, The Brown Instrument Company, Philadelphia, Pennsylvania.
- HARRISON, WILLIAM W.**, Merchant, 119 North 11th Street, Philadelphia, Pennsylvania.
- HART, CHARLES**, President, Delaware River Steel Company, Chester, Pennsylvania.
- HART, EDWARD**, Professor of Chemistry, Lafayette College, Easton, Pennsylvania.
- HARTNESS, JAMES**, President, Jones and Lamson Machine Company, and for mail, 30 Orchard Street, Springfield, Vermont.
- HARTUNG, ADOLPH**, Paper Merchant, 506 Race Street, Philadelphia, Pennsylvania.

... Merchant, 921 North Delaware Avenue, Phila-
 ... Biological Chemist, Constantine Hering Laboratory,
 ... 70 North Broad Street, Philadelphia, Pennsylvania.
 ... Technical Engineer, 1317 Spruce Street, Philadelphia, Penn-
 ... The Globe Ticket Company, 112 North 12th Street,
 ... Vestinghouse Electric and Manufacturing Company, Westing-
 ... New York City, New York.
 ... Metallurgy, University of California, Berkeley, California.
 ... 1 Madison Avenue, New York City, New York.
 ... Manufacturer, 4635 Walnut Street, Philadelphia, Pennsylvania.
 ... Mechanical Engineer, P. O. Box 366, West Chester, Pennsylvania.
 ... Manufacturer of Farm Implements, 4516 Fremont Avenue, South
 ... Scientific Instrument Maker, 2207-13 Bellevue Avenue, Phila-
 ... General Manager, Yellow Cab Company, 1734 North
 ... Engineer, Rooms 5-6, 5 West Eighth Street, Cincinnati, Ohio.
 ... Atlas Powder Company, Tamaqua, Pennsylvania.
 ... The Hans Hinrich Chemical Corporation, 227 Fulton Street,
 ... New York
 ... Manufacturing Chemist, 206 South 24th Street, Philadelphia, Penn-
 ... President, Metal and Thermit Corporation, 120 Broad-
 ... New York
 ... 67 Maple Avenue, Warwick, New York.
 ... Research Chemist, 33 West 60th Street, New York City, New York.
 ... Graduate Student, Massachusetts Institute of Technology,
 ...
 ... Acting Secretary, The Franklin Institute, Philadelphia, Penn-
 ... Baltimore, Pennsylvania.
 ... Book Book Maker, Lithographer, 247-53 South American Street,
 ...
 ... Research Engineer, Philadelphia Storage Battery Company, Ontario
 ... Philadelphia, Pennsylvania.
 ... Chemist and Chemical Engineer, in care of Rohm and Haas
 ... Philadelphia
 ... Journalist, 135 Garrison Avenue, Jersey City, New Jersey.
 ... Engineer, Harvard Road, Brookline, Delaware County, Penn-
 ...
 ... Ridgewood, Maryland.
 ... Development and Research Department American
 ... Company, 198 Broadway, New York City, New York.
 ... and Sugar Refiner, 82 Remsen Street, Brooklyn, New York
 ... Mechanical Engineer, 1000 Chestnut Street, Philadelphia, Penn-
 ...
 ... Montgomery Avenue, Bryn Mawr, Pennsylvania.

- HOWE, ARTHUR W.**, Broker, 1811 Walnut Street, Philadelphia, Pennsylvania.
HOWELL, JOHN W., Engineer, Lamp Works, General Electric Company, Harrison, New Jersey.
HOWER, Professor HARRY S., Physicist, Carnegie Institute of Technology, and for mail, 5709 Solway Street, Pittsburgh, Pennsylvania.
HOWSON, CHARLES HENRY, Patent Solicitor and Engineer, 32 South Broad Street, Philadelphia, Pennsylvania.
HOWSON, MISS EMILY E., Instructor in Physics, Agnes Scott College, Decatur, Georgia.
HOWSON, HENRY, Patent Solicitor and Engineer, West End Trust Building, Philadelphia, Pennsylvania.
HOWSON, RICHARD, 32 South Broad Street, Philadelphia, Pennsylvania.
HUFF, ERNEST L., Electrical Engineer, Natrona, Pennsylvania.
HUSTON, GEORGE A., Banker, 1600 Walnut Street, Philadelphia, Pennsylvania.
HUMPHREYS, ALEXANDER C., Consulting Engineer, President, Stevens Institute of Technology, Hoboken, New Jersey.
HUMPHREYS, Dr. W. J., Physicist, Weather Bureau, Washington, D. C.
HUSTON, CHARLES L., Vice-President, Lukens Steel Company, Coatesville, Pennsylvania.
HUTCHINSON, S. PEMBERTON, President, Westmoreland Coal Company, 224 South 3rd Street, Philadelphia, Pennsylvania.
HUTTINGER, W. R., Mechanical Engineer, 86 East Greenwood Avenue, Lansdowne, Pennsylvania.
HYATT, CLINTON BROWN, Radio Experimenter, Melrose Park, Pennsylvania.
INDAHL, MAURITZ C., Mechanical Engineer, 248 East Johnson Street, Philadelphia, Pennsylvania.
INGERSOLL, CHARLES EDWARD, Attorney-at-Law, President Central National Bank, 5th and Chestnut Streets, and for mail, 1815 Walnut Street, Philadelphia, Pennsylvania.
INSULL, SAMUEL, President, Commonwealth Edison Company, 72 West Adams Street, Chicago, Illinois.
IRISH, WILLIAM MITCHELL, Vice-President and General Manager, The Atlantic Refining Company, 260 South Broad Street, Philadelphia, Pennsylvania.
IRONS, ROBERT HATFIELD, President, Central Iron and Steel Company, Harrisburg, Pennsylvania.
ISRAEL, JOSEPH D., District Manager, The Philadelphia Electric Company, 10th and Chestnut Streets, Philadelphia, Pennsylvania.
ITTNER, MARTIN HILL, Chief Chemist, Colgate and Company, Jersey City, New Jersey.
IVES, FRED E., Inventor, 1726 North Park Avenue, Philadelphia, Pennsylvania.
IVES, Dr. HERBERT E., Physicist, in care of Western Electric Company, 463 West Street, New York City, New York.
JACKSON, A. C., Manufacturer, 4530 Tacony Street, Philadelphia, Pennsylvania.
JACKSON, Dr. JOHN PRICE, Room 702, New York Edison Company, Irving Place and 15th Street, New York City, New York.
JACKSON, WILLIAM STEELL, Patent Attorney, 1001 Chestnut Street, Philadelphia, Pennsylvania.
JACOBUS, D. S., Advisory Engineer, The Babcock and Wilcox Company, 85 Liberty Street, New York City, New York.
JAMES, WILLIAM FOY, Manager, Industrial Division Philadelphia Office, Westinghouse Electric and Manufacturing Company, and for mail, 6920 Boyer Street, Mt. Airy, Philadelphia, Pennsylvania.
JEANES, ISAAC W., Room 908, Lafayette Building, Philadelphia, Pennsylvania.
JEFFERSON, J. P., Manufacturer, P. O. Box 645, Santa Barbara, California.
JEFFERIES, ZAY, Metallurgical Engineer, in care of Aluminum Castings Company, 2800 Harvard Avenue, Cleveland, Ohio.
JENKINS, C. FRANCIS, Inventor, 5502 16th Street, N. W., Washington D. C.
JENKINS, THEODORE, F., Attorney-at-Law, 1100 Liberty Building, Broad and Chestnut Streets, Philadelphia, Pennsylvania.
JENNINGS, W. N., Business Photographer, 1321 Arch Street, Philadelphia, Pennsylvania.
JOB, ROBERT, Vice-President, Milton Hersey Company, Limited, 84 St. Antoine Street, Montreal, Quebec, Canada.
JODIDI, Dr. SAMUEL L., Chemist, U. S. Department of Agriculture, Washington, D. C.
JOHANSEN, ERNST, Chemist, New England Oil Refining Company, Fall River, Massachusetts.
JOHNSON, CLARENCE NATHAN, Electrical Engineer, Westinghouse Electric and Manufacturing Company, 30th and Walnut Streets, Philadelphia, Pennsylvania.
JOHNSON, ERNEST EDWARD, Professor of Physics, Northeast High School, Philadelphia, Pennsylvania, and for mail, 5850 North 6th Street, Philadelphia, Pennsylvania.
JOHNSON, JAMES CURTIS, General Superintendent of Telegraph, Pennsylvania Railroad Company, 812 Fox Building, Philadelphia, Pennsylvania.
JOHNSON, WALTER H., First Vice-President Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
JOHNSON, WILLIAM A., President, Williams, Brown and Earle, 918 Chestnut Street, Philadelphia, Pennsylvania.
JOHNSTON, JOHN, Chemist, Sterling Laboratory, Yale University, New Haven, Connecticut.
JONES, JONATHAN, Engineer, P. O. Box 1593, Pittsburgh, Pennsylvania.
JONES, JONATHAN R., Iron and Steel Manufacturer, 1800 Widener Building, Philadelphia, Pennsylvania.
JONES, JULIAN D., Superintendent, Telegraph and Signals, Eastern Region, Pennsylvania System, Room 152, Broad Street Station, Philadelphia, Pennsylvania.
JONES, PHILIP CHAPIN, Electrical Engineer, Goodyear Tire and Rubber Company, Akron, Ohio, and for mail, 514 Burwell Street, Akron, Ohio.
JONES, W. CLYDE, Attorney-at-Law, 77 West Washington Street, Chicago, Illinois.

- JUNKERSFELD, PETER**, Engineering and Construction, 68 Trinity Place, New York City, New York.
- JUSTI, HENRY M.**, 32nd and Spring Garden Streets, Philadelphia, Pennsylvania.
- KABAKJIAN, Dr. D. H.**, Assistant Professor of Physics, University of Pennsylvania, Philadelphia, Pennsylvania.
- KALTENTHALER, H. J.**, Manufacturer of Steam Specialties, 6457 Woodbine Avenue, Overbrook, Philadelphia, Pennsylvania.
- KARRER, ENOCH**, Physicist, National Lamp Works of General Electric Company, Wire Division, 1770 East 45th Street, Cleveland, Ohio.
- KAUFMANN, HERBERT M.**, Vice-President, Mutual Chemical Company of America, 110 William Street, New York City, New York, and for mail, 270 Madison Avenue, New York City, New York.
- KAVANAUGH, WM. H.**, Professor of Experimental Engineering, Towne Scientific School, University of Pennsylvania, Philadelphia, Pennsylvania.
- KEBLER, LEONARD**, President, Ward Leonard Electric Company, Mt. Vernon, New York, and for mail, 21 Ridge Road, Bronxville, New York.
- KEEFER, WILLIAM B.**, Address unknown.
- KEITH, C. P.**, in care of W. G. Peters, 69 Van Antwerp Road, Schenectady, New York.
- KELLER, E. E.**, Engineer and Manufacturer, Braywood, Quarton Road, Birmingham, Michigan.
- KELLERS, CHARLES FREDERICK, M. S. N. C.**, Union College, Schenectady, New York.
- KELLEY, Dr. GEORGE L.**, Research Chemist, 6804 McCallum Street, Philadelphia, Pennsylvania.
- KELLOGG, HOSFORD D.**, Manager, The H. B. Smith Company, 17th and Arch Streets, Philadelphia, Pennsylvania.
- KEMMERER, M. S.**, Coal Merchant, Mauch Chunk, Pennsylvania.
- KENNEDY, FRANK G., Jr.**, President, Logan Iron and Steel Company, 1218 Stephen Girard Building, and for mail, 2043 Spruce Street, Philadelphia, Pennsylvania.
- KENNEDY, JOHN H.**, Address unknown.
- KENNEDY, J. J.**, Consulting Engineer, 52 Broadway, New York City, New York.
- KENNEDY, M. C.**, Vice-President, Pennsylvania Railroad Company, Broad Street Station, Philadelphia, Pennsylvania.
- KENNELLY, Dr. A. E.**, Professor of Electrical Engineering, Harvard University, Cambridge, Massachusetts.
- KENT, A. ATWATER**, Manufacturer, Ardmore, Pennsylvania.
- KENT, S. LEONARD, Jr.**, Hydro-Electrics, Manayunk, Philadelphia, Pennsylvania.
- KERLIN, W. D.**, Secretary and Treasurer, Camden Forge Company, Camden, New Jersey.
- KERR, WILLIAM M.**, Manufacturer, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- KETCHAM, O. W.**, Manufacturer of Architectural Terra Cotta, 125 North 18th Street, Philadelphia, Pennsylvania.
- KETTERLINUS, J. L.**, Lithographer, 4th and Arch Streets, Philadelphia, Pennsylvania.
- KILPATRICK, J. L.**, 181 Ridgewood Avenue, Glen Ridge, New Jersey.
- KIMBER, WILLIAM, M. C.**, Manufacturer of Electrical Instruments, Sword and Kimber Company, 4861 Stenton Avenue, Philadelphia, Pennsylvania.
- KINEALY, JOHN HENRY**, Consulting Engineer, 503 Granite Building, St. Louis, Missouri.
- KING, CHARLES, W. G.**, Mechanical Engineer, 6201 Park Boulevard, Wildwood Crest, New Jersey.
- KING, JOSEPH B., Jr.**, Assistant in Research Laboratory, Electric Storage Battery Company, and for mail, 7315 Boyer Street, Mt. Airy, Philadelphia, Pennsylvania.
- KINGSBURY, Dr. EDWIN F.**, Physicist, Western Electric Company, 463 West Street, New York City, New York.
- KINNARD, L. H.**, President, The Bell Telephone Company, 1631 Arch Street, Philadelphia, Pennsylvania.
- KINNIER, GEORGE E.**, Civil Engineer, 464 New Street, Bethlehem, Pennsylvania.
- KIPPENBERG, HENRY**, in care of Merck and Company, Rahway, New Jersey.
- KIRK, C. J.**, President, United States Sherardizing Company, New Castle, Pennsylvania.
- KIRSOPP, EDGAR C. B.**, Assistant Treasurer, Rohm and Haas Company, Inc., Bristol, Pennsylvania and for mail, 40 North Front Street, Philadelphia, Pennsylvania.
- KLEMM, J. GEORGE, Jr.**, Heating and Ventilating Engineer, Box 284, Haverford, Pennsylvania.
- KLINE, C. MAHLON**, Wholesale Druggist, 105 North 5th Street, Philadelphia, Pennsylvania.
- KLIPSTEIN, A.**, Merchant, 644-54 Greenwich Street, New York City, New York.
- KLUMPP, JOHN BARTLEMAN**, Inspecting Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- KNAPP, ARTHUR**, Petroleum Engineer, Box 1902, Philadelphia, Pennsylvania.
- KNAPP, I. N.**, Engineer, 504 Aspen Street, N. W., Tacoma Park, Washington, D. C.
- KNEASS, STRICKLAND L.**, Mechanical Engineer, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- KNOEDLER, E. L.**, General Superintendent, The Welsbach Company, Gloucester, New Jersey.
- KNOX, HENRY HOBART**, Mining Engineer, 160 Broadway, New York City, New York.
- KOCH, JULIUS A.**, Professor of Chemistry and Dean of School of Pharmacy, University of Pittsburgh, Bluff and Pride Streets, Pittsburgh, Pennsylvania.
- KOHN, JOSEPH**, Secretary and Treasurer, Universal Dental Company, 5416 Woodcrest Avenue, Philadelphia, Pennsylvania.
- KOTHNY, G. L.**, Consulting Engineer, C. H. Wheeler Manufacturing Company, and for mail Woodland Road, Stratford, Pennsylvania.
- KREBS, A. S.**, Mechanical Engineer, Krebs Pigment and Chemical Company, Newport Delaware.
- KREBS, H. J.**, President, Krebs Pigment and Chemical Company, P. O. Box 951, Wilmington, Delaware.

- KRISCHKER, Mrs. R. H.**, Address Unknown.
- KRUTTSCHNITT, J.**, Civil Engineer, Southern Pacific Company, 165 Broadway, New York City, New York.
- KUESEL, Dr. GEORGE C.**, Dentist, 1614 Locust Street, Philadelphia, Pennsylvania.
- KUHN, C. HARTMAN**, 202 Liberty Building, Philadelphia, Pennsylvania.
- KUNZ, Dr. GEORGE F.**, President, The American Scenic and Historic Preservation Society, 409 Fifth Avenue, New York City, New York.
- KUTTROFF, EDWIN**, President, Verona Chemical Company, North Newark, New Jersey.
- LAIRD, CLINTON N.**, Chemist, 208 McMechen Street, Baltimore, Maryland.
- LANDRETH, C. P.**, Manufacturer, Electrolytic Purification Company, 15th Street and Lehigh Avenue, Philadelphia, Pennsylvania.
- LATHROP, ELBERT CLYDE**, Chemist, 4634 Sansom Street, Philadelphia, Pennsylvania.
- LANZA, GAETANO**, Engineer, Special Consultant, The Baldwin Locomotive Works, Philadelphia, Pennsylvania, and for mail, 5624 Cedar Avenue, Philadelphia, Pennsylvania.
- LAUER, CONRAD**, General Manager, Day and Zimmermann, and for mail, 233 West Hortic Street, Germantown, Philadelphia, Pennsylvania.
- LAVINO, E. J.**, Merchant, 471 Bullitt Building, Philadelphia, Pennsylvania.
- LAWALL, CHARLES H.**, Analytical Chemist, 636 Franklin Square, Philadelphia, Pennsylvania.
- LAWLER, G. S.**, Electrical Engineer, Associated Factory Mutual Fire Insurance Companies, Fort Hill Square, 184 High Street, Boston, Massachusetts.
- LAWRENCE, RUSSELL E.**, Dean of Engineering, University of Detroit, 630 East Jefferson Avenue, Detroit, Michigan.
- LAY, JOHN TRACY**, Research Assistant in Physics, University of Pennsylvania, and for mail, 4015 Pine Street, Philadelphia, Pennsylvania.
- LE BOUTILLIER, HENRY W.**, Chemist, Wayne, Pennsylvania.
- LE BOUTILLIER, ROBERT**, Wayne, Pennsylvania.
- LEDoux, J. W.**, Chief Engineer, American Pipe Manufacturing Company, 112 North Broad Street, Philadelphia, Pennsylvania.
- LEE, ELISHA**, Vice-President in Charge of Operation, Broad Street Station, Philadelphia, Pennsylvania.
- LEE, JAMES D., Jr.**, 5929 Greene Street, Germantown, Philadelphia, Pennsylvania.
- LEE, WALTER T.**, Accountant, 308 Rex Avenue, Chestnut Hill, Philadelphia, Pennsylvania.
- LEEDS, MORRIS E.**, Manufacturer of Scientific Instruments, 4901 Stenton Avenue, Germantown, Philadelphia, Pennsylvania.
- LEFFMANN, HENRY**, Chemist, The Franklin Institute, Philadelphia, Pennsylvania.
- LEIGHNINGER, WILLIAM B.**, Teacher of Chemistry, Frankford High School, and for mail, 505 West Chelton Avenue, Germantown, Philadelphia, Pennsylvania.
- LE MAISTRE, F. J.**, Chemical Engineer, 810 Bellevue Court Building, Philadelphia, Pennsylvania.
- LEMOINE, L. R.**, President, United States Cast Iron Pipe and Foundry Company, Morris Building, Philadelphia, Pennsylvania.
- LENHER, VICTOR**, Chemist, 1718 Summit Avenue, Madison, Wisconsin.
- LENKER, WILL G.**, Civil Engineer, 405 Chestnut Street, Sunbury, Pennsylvania.
- LESLEY, ROBERT W.**, Manufacturer, 612 Pennsylvania Building, Philadelphia, Pennsylvania.
- LEVY, HOWARD S.**, 1424 North 15th Street, Philadelphia, Pennsylvania.
- LEVY, LIONEL FARADAY**, Chemical Engineer, Manager, Repro Art Machinery Company, and for mail, 220 West Roberts Avenue, Philadelphia, Pennsylvania.
- LEVY, MAX**, Manufacturer and Photo-Engraver, Lenox Apartments, 13th and Spruce Streets, Philadelphia, Pennsylvania.
- LEWIS, A. NELSON**, Attorney-at-Law, 1811 Walnut Street, Philadelphia, Pennsylvania.
- LEWIS, DANIEL C.**, Agent, The Millville Manufacturing Company, Millville, New Jersey.
- LEWIS, GEORGE W.**, Mechanical Engineer, National Advisory Committee for Aeronautics, 2722 Navy Building, Washington, D. C.
- LEWIS, HOWARD W.**, Banker, 1928 Spruce Street, Philadelphia, Pennsylvania.
- LEWIS, JOHN F.**, Attorney-at-Law, 208 South 4th Street, Philadelphia, Pennsylvania.
- LEWIS, NATHAN E.**, Mechanical Engineer, Babcock and Wilcox Company, 85 Liberty Street, New York City, New York.
- LEWIS, PAUL A.**, Physician, Rockefeller Institute for Medical Research, Department of Animal Pathology, Princeton, New Jersey.
- LEWIS, ROBERT B.**, Mechanical Engineer, 51 East Penn Street, Germantown, Philadelphia, Pennsylvania.
- LEWIS, WILFRED**, Mechanical Engineer, President, The Tabor Manufacturing Company, and for mail, Rose Lane, Haverford, Pennsylvania.
- LICHTENBERG, Captain CHESTER**, Electrical Engineer, 136 Waverly Place, Schenectady, New York.
- LIEB, J. W.**, Vice-President, The New York Edison Company, 15th Street and Irving Place, New York City, New York.
- LIEBER, HUGO**, Chemist, President, H. Lieber and Company, 19 West 44th Street, New York City, New York.
- LIGHTFOOT, THOMAS M.**, Retired Educator, Chesham, New Hampshire.
- LIHME, I. P.**, Chemical Engineer, The Grasselli Chemical Company, Cleveland, Ohio.
- LILLIE, LEWIS**, Vice-President, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- LILLIE, S. MORRIS**, President, Sugar Apparatus Refining Company, 4804 Springfield Avenue, Philadelphia, Pennsylvania.
- LINDENTHAL, GUSTAV**, Consulting Engineer, Room 738 Pennsylvania R. R. Station, New York City, New York.
- LIPPINCOTT, J. BERTRAM**, Publisher, 227 South 6th Street, Philadelphia, Pennsylvania.

- LIPPINCOTT, JOSEPH W., Publisher, Bethayres, Pennsylvania.
- LITTLE, ARTHUR D., President, Arthur D. Little, Incorporated, 30 Charles River Road, Cambridge, Massachusetts.
- LIVERSIDGE, HORACE P., Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- LIVINGSTON, HERMAN, Hydro Carbon Engineer, Calco Chemical Company, Richards Park, Somerville, New Jersey.
- LLEWELLYN, W. H., Druggist, 1518 Chestnut Street, Philadelphia, Pennsylvania.
- LLOYD, HERBERT, President, Electric Storage Battery Company, Philadelphia, Pennsylvania.
- LLOYD, JOHN URI, Manufacturing Pharmacist and Chemist, Clifton and Lafayette Avenues, Cincinnati, Ohio.
- LLOYD, MORTON G., Electrical Engineer, Bureau of Standards, Washington, D. C.
- LOBBEN, PEDER, Mechanical Engineer, Room No. 2, Keyers Gade 1, Kristiania, Norway.
- LODGE, ROLLA M., Engineer and Electrician, 1149 Venango Street, Philadelphia, Pennsylvania.
- LOEB, LEO, Mechanical Engineer, Albert B. Manuel, 61 Broadway, New York City, New York, and for mail, 302 Park Street, Montclair, New Jersey.
- LONERGAN, J. E., Brass Manufacturer, 211 Race Street, Philadelphia, Pennsylvania.
- LONGSTRETH, CHARLES, 611 A Avenue, Coronado, California.
- LONGSTRETH, EDWARD T., Manufacturer, 6805 North 11th Street, Oak Lane, Philadelphia, Pennsylvania.
- LORENTZ, HENDRIK A., Physicist, Zylweg 76, Haarlem, Holland.
- LOSS, HENRIK von ZERNIKOW, Consulting Engineer, Hotel Bristol, Kristiania, Norway.
- LOVEJOY, J. R., Vice-President, General Electric Company, Schenectady, New York.
- LOVEKIN, LUTHER D., Marine Engineer, Mill Creek Road, Ardmore, Pennsylvania.
- LOWE, ARTHUR W., Public School Teacher, 1224 Herbert Street, Frankford, Philadelphia, Pennsylvania.
- LOWER, NATHAN M., Assistant General Manager, Locomotive Stoker Company, 292 Balph Avenue, Bellevue, Pennsylvania.
- LOYD, SARAH A. C., 1206 Filbert Street, Philadelphia, Pennsylvania.
- LUCAS, FRANCIS F., Engineer, Bell Telephone Laboratories, Incorporated, 463 West Street, New York City, New York.
- LUCKE, CHARLES EDWARD, Professor of Mechanical Engineering, Columbia University, New York City, New York.
- LUCKIESH, Dr. M., Director of Applied Science, Nela Research Laboratories, Nela Park, Cleveland, Ohio.
- LUKENS, Dr. HIRAM S., Chemist, Harrison Laboratory, University of Pennsylvania, 34th and Spruce Streets, Philadelphia, Pennsylvania.
- LUPTON, EDWARD, Manufacturer of Sheet Metal, Allegheny Avenue and Tulip Street, Philadelphia, Pennsylvania.
- LYMAN, JAMES, Consulting Engineer, Member of Firm, Sargent & Lundy, 1412 Edison Building, Chicago, Illinois.
- LYNCH, JOHN COPPER, Vice-President, The Bell Telephone Company of Pennsylvania, 1631 Arch Street, Philadelphia, Pennsylvania.
- LYON, PERCY S., Chief Engineer, H. S. B. W. Cochrane Corporation, 17th Street and Allegheny Avenue, Philadelphia, Pennsylvania.
- LYSLE, FREDERIC BOWERS, Chemist-Engineer, Room 900, City Hall, Philadelphia, Pennsylvania.
- McARTHUR, GEORGE P., Mechanical Engineer, Joseph Oat and Sons, 232 Quarry Street, Philadelphia, Pennsylvania.
- McBRIDE, THOS. C., Sales Manager, Worthington Pump and Machinery Corporation, 1516 North American Building, Philadelphia, Pennsylvania.
- McCALL, JOSEPH B., Chairman, Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- McCALL, RICHARD C., 2115 Locust Street, Philadelphia, Pennsylvania.
- McCLELLAND, GEORGE W., Instructor in Mathematics, 3112 Troost Avenue, Kansas City, Missouri.
- McCONNELL, FRANKLIN P., Day and Zimmermann, Incorporated, 1600 Walnut Street, Philadelphia, Pennsylvania, and for mail, 706 Spruce Street, Philadelphia, Pennsylvania.
- McCONNELL, JACOB Y., Mechanical Engineer, 100 S. 4th Street, Darby, Pennsylvania.
- McCORMACK, H., Professor of Chemical Engineering, Armour Institute of Technology, Chicago, Illinois.
- McDONALD, HUNTER, Chief Engineer, N. C. and St. L. Ry. Company, 924 Broadway, Nashville, Tennessee.
- McDOWELL, CHARLES, Paper Manufacturer, Main and Levering Streets, Manayunk, and for mail, 5804 Greene Street, Germantown, Philadelphia, Pennsylvania.
- McFADDEN, GEORGE H., Merchant, 121 Chestnut Street, Philadelphia, Pennsylvania.
- McGEORGE, PERCY, 711 Bullitt Building, Philadelphia, Pennsylvania.
- McGOWAN, J. Jr., Assistant General Manager, Campbell Soup Company, 2nd and Market Streets, Camden, New Jersey.
- McILHENNY, JOHN D., 17th and Clearfield Streets, Philadelphia, Pennsylvania.
- McKAIG, W. WALLACE, Mechanical Engineer, Cumberland, Maryland.
- McKEEHAN, Dr. L. W., Research Physicist, Western Electric Company, 463 West Street, New York City, New York.
- McLEAN, WILLIAM L., Publisher, The Evening Bulletin, Philadelphia, Pennsylvania.
- McMEekin, Major C. W., 343 Rialto Building, San Francisco, California.
- McVEY, JOHN JOSEPH, Publisher & Bookseller, 1229 Arch Street, Philadelphia, Pennsylvania.

- MACALPINE, J. KENNETH, W.**, Chemistry Teacher, New York University, Washington Square, and for mail, Box 39, Hartley Hall, Columbia University, New York City, New York.
- MacBAIN, D. R.**, Assistant General Manager, New York Central Railroad Company, Cleveland, Ohio.
- MacBETH, NORMAN**, Illuminating Engineer, 227 West 17th Street, New York City, New York.
- MacGREGOR, FRANK S.**, Development Department, E. I. du Pont de Nemours and Company 452 Du Pont Building, Wilmington, Delaware.
- MACKENZIE, K. G.**, Consulting Chemist. The Texas Company, 17 Battery Place, New York City, New York.
- MacLEAN, GEORGE**, President, Ives Inventions, Port Washington, New York.
- MADEIRA, PERCY C.**, Coal Operator, North American Building, Philadelphia, Pennsylvania.
- MAILLOUX, Dr. C. O.**, Consulting Engineer, 111 Fifth Avenue, New York City, New York.
- MAITLAND, HAROLD T.**, Oil Chemist, Sharon Hill, Pennsylvania.
- MAIZLISH, Dr. ISRAEL**, Instructor in Physics, 53 Warren Street, Lynn, Massachusetts.
- MALLINCKRODT, E., Jr.**, Manufacturing Chemist, Mallinckrodt Chemical Works, St. Louis, Missouri.
- MANNING, EUGENE REYNOLDS**, Chemical Engineer, Harrison Laboratory, University of Pennsylvania, Philadelphia, and for mail, 32 West Ridley Avenue, Ridley Park, Pennsylvania.
- MANWARING, ALBERT H.**, Electrical Engineer, The Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- MARBAKER, Dr. EDWARD**, Chemist, Mellon Institute, Pittsburgh, Pennsylvania.
- MARCONI, GUGLIELMO**, Senator, Electrical Engineer and Inventor, 31 Via Garibaldi Gianicolo, Rome, Italy.
- MARKLE, A.**, Mining Engineer, Hazleton, Pennsylvania.
- MARKLE, JOHN**, Mining Engineer and Coal Operator, in care of Mr. A. B. Jessup, Jeddo, Pennsylvania.
- MARSHALL, THOS. H.**, Carpenter and Builder, Carpenter's Hall, 320 Chestnut Street, Philadelphia, Pennsylvania.
- MARTIN, THOMAS S., 3rd**, Civil Engineer, 7205 Cresheim Road, Germantown, Philadelphia, Pennsylvania.
- MARTOCCELLO, JOSEPH A.**, Manufacturer Raw Water Ice Making Appliances, 229 North 13th Street, Philadelphia, Pennsylvania.
- MASLAND, CHARLES H., 2nd**, Chemical Engineer, 1128 Foulkrod Street, Frankford, Philadelphia, Pennsylvania.
- MASON, CHARLES THOMAS**, Electrical Engineer, President, Sumter Electric Company, Sumter, South Carolina.
- MASON, SIDNEY**, President, Welsbach Company, Gloucester City, New Jersey.
- MASON, W. P.**, Professor of Chemistry, Rensselaer Polytechnic Institute, Troy, New York.
- MASTERS, Major FRANK M.**, Consulting Engineer, Calder Building, Harrisburg, Pennsylvania.
- MATHEWS, Dr. JOSEPH HOWARD**, Professor in Chemistry, University of Wisconsin, Madison, Wisconsin.
- MATTHEWS, W. G.**, Address unknown.
- MAXFIELD, H. H.**, General Superintendent, Pennsylvania System, 402 Pennsylvania Building, Wilmington, Delaware.
- MAYER, NELSON B.**, Merchant, Hotel Marie Antoinette, Broadway and 67th Street, New York City, New York.
- MEASEY, WILLIAM MAUL**, Attorney-at-Law, 1328 Chestnut Street, Philadelphia, and for mail, Box 208, Haverford, Pennsylvania.
- MEEKER, G. H.**, Professor of Chemistry, School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania.
- MEES, C. E. K.**, Eastman Kodak Company, Kodak Park Works, Rochester, New York.
- MELCHER, WM. C., Jr.**, c/o I. P. Morris Department, William Cramp and Sons, Ship and Engine Building Company, Philadelphia, Pennsylvania.
- MELLOR, NORMAN**, Manufacturer, Wayne Junction, Philadelphia, Pennsylvania.
- MELODY, MICHAEL**, Bailey Building, Philadelphia, Pennsylvania.
- MERRICK, JAMES HARTLEY**, Acting Vice-Provost, University of Pennsylvania, and for mail, No. 20 Cleemann House, University Dormitories, Philadelphia, Pennsylvania.
- MERRICK, J. V.**, Roxborough, Philadelphia, Pennsylvania.
- MERRIMAN, THADDEUS**, Chief Engineer, Board of Water Supply, Municipal Building, New York City, New York.
- MERRITT, JAMES SMITH**, Mechanical Engineer, Abington, Pennsylvania.
- MERSHON, R. D.**, Consulting Engineer, 80th Street and East End Avenue, New York City, New York.
- MERZ, CHARLES H.**, Consulting Engineering, 32 Victoria Street, London, S. W., England.
- MERZ, EUGENE**, Manufacturer, The Heller and Merz Company, 338 Wilson Avenue, Newark, New Jersey.
- METTEN, JOHN F.**, Chief Engineer, Wm. Cramp & Sons, Ship & Engine Building Company, Richmond and Norris Streets, Philadelphia, Pennsylvania.
- METZ, HERMAN A.**, Manufacturer and Importer of Chemicals and Dyestuffs, 122 Hudson Street, New York City, New York.
- MICHELSON, A. A.**, Professor of Physics, University of Chicago, Chicago, Illinois.
- MIDDLETON, ALBERT C.**, Director, 149 East Main Street, Moorestown, New Jersey.
- MILES, J. WALTER**, Electrical Engineer, Irwin, Pennsylvania.
- MILLER, CASPER W.**, Physician, Wallingford, Pennsylvania.
- MILLER, FRED J.**, Factory Manager, New Hope, Pennsylvania.
- MILLER, SIMON**, Textile Manufacturer, 1530 Locust Street, S-B, Philadelphia, Pennsylvania.

- MILLER, W. LASH**, Professor of Physical Chemistry, 8 Hawthorne Avenue, Toronto, Canada.
- MILLIKEN, J.**, President, Pittsburgh Testing Laboratories, P. O. Box 1115, Pittsburgh, Pennsylvania.
- MILLS, GEO. M.**, President, Thomas Mills and Brothers, Incorporated, 1301 North 8th Street, Philadelphia, Pennsylvania.
- MILNE, DAVID**, Manufacturer, School House Lane, Germantown, Philadelphia, Pennsylvania.
- MILNE, FRANCIS F., Jr.**, 1714 Spruce Street, Philadelphia, Pennsylvania.
- MILNER, B. B.**, Engineer of Motive Power, Room 1237, Knickerbocker Building, Times Square, New York City, New York.
- MINER, Dr. HARLAN S.**, Chief Chemist, Welsbach Company, Gloucester, New Jersey.
- MISSIMER, GEORGE, Jr.**, Farmer, West Port Royal Avenue, Roxborough, Philadelphia, Pennsylvania.
- MITCHELL, HENRY F.**, Glazed Kid Manufacturer, 36th and Reed Streets, Philadelphia, Pennsylvania.
- MITCHELL, Dr. WALTER M.**, Metallurgical Engineer, Chemical Department, E. I. du Pont de Nemours & Company, Wilmington, Delaware, and for mail, 112 North 34th Street, Philadelphia, Pennsylvania.
- MITCHESON, JOSEPH MacGREGOR**, Assistant City Solicitor, 1018 Stock Exchange Building, Philadelphia, Pennsylvania.
- MITTEN, T. E.**, Chairman of Executive Committee, Philadelphia Rapid Transit Company, 1520 Spruce Street, Philadelphia, Pennsylvania.
- MIXER, CHARLES A.**, Engineer, Rumford Falls Power Company, Rumford, Maine.
- MODJESKI, RALPH**, Consulting Civil Engineer, 818 Widener Building, Philadelphia, Pennsylvania.
- MOODY, LEWIS FERRY**, Consulting Engineer, William Cramp and Sons Ship and Engine Building Company, Richmond and Norris Streets, Philadelphia, Pennsylvania.
- MOORE, DAVID PELTON**, Patent Attorney, Warder Building, Washington, D. C.
- MOORE, HORACE E.**, Superintendent, Chester Heights, Delaware County, Pennsylvania.
- MOORE, W. E.**, President, W. E. Moore and Company, Engineers, Room 706, Union Bank Building, Pittsburgh, Pennsylvania.
- MORAN, DANIEL E.**, 9 East 45th Street, New York City, New York.
- MORGAN, D. BRUCE**, Consulting Engineer, Hotel St. Paul, 60th Street and Ninth Avenue, New York City, New York.
- MORAN, ROBERT (Retired)**, Rosario, San Juan County, Washington.
- MORGAN, MARSHALL S.**, Fidelity Trust Company, 325 Chestnut Street, Philadelphia, Pennsylvania.
- MORGAN, RANDAL**, First Vice-President, United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- MORRIS, A. SAUNDERS**, Mechanical Engineer, Haverford, Pennsylvania.
- MORRIS, EFFINGHAM B.**, Girard Trust Company, Philadelphia, Pennsylvania.
- MORRISSEY, JOHN P.**, Professor of Chemistry, 651 East Jefferson Avenue, Detroit, Michigan.
- MOYER, J. A.**, Director, Massachusetts Board of Education, State House, Boston, Massachusetts.
- MULL, J. HARRY**, President and General Manager, The William Cramp & Sons, Ship and Engine Building Company, Richmond and Norris Streets, Philadelphia, Pennsylvania.
- MULLER, EDWARD ALBERT**, Vice-President and Secretary, The King Machine Tool Company, Winton Place, Cincinnati, Ohio.
- MÜLLER, RALPH H.**, Chemical Engineer, 485 Rogers Avenue, Brooklyn, New York.
- MUNROE, Captain CHARLES W. (Retired)**, 205 Elm Avenue, Swarthmore, Pennsylvania.
- MURDOCK, JOSEPH B.**, Rear Admiral, U. S. N. (Retired), Danbury, New Hampshire.
- MURPHY, F. M.**, 907 East 6th Street, Tucson, Arizona.
- MURRAY, B. L.**, Chemist, Merck and Company, Rahway, New Jersey.
- MURRAY, HENRY H.**, Mechanical Engineer, Victor Talking Machine Company, Camden, New Jersey, and for mail, 204 Lippincott Avenue, Riverton, New Jersey.
- MURRAY, J. F.**, Assistant to Chief Engineer, Pennsylvania Railroad Company, 607 Broad Street Station, Philadelphia, Pennsylvania.
- MURRAY, THOMAS E.**, Consulting Electrical Engineer, 124 East 15th Street, New York City, New York.
- MURRAY, WILLIAM S.**, Consulting Engineer, 709 Sixth Avenue, New York City, New York.
- MYERS, ALLEN I.**, 314 North Chester Road, Swarthmore, Pennsylvania.
- NEBLETTE, CARROL BERNARD**, Department of Photography, Texas A. and M. College, College Station, Texas.
- NEILER, SAMUEL G.**, Consulting Mechanical and Electrical Engineer, 1409 Manhattan Building, Chicago, Illinois.
- NETHERY, JOHN E. (Retired)**, Address unknown.
- NEWBOLD, CLEMENT B.**, Banker 511 Chestnut Street, Philadelphia, Pennsylvania.
- NICE, EUGENE E.**, Manufacturer, 272 South 2nd Street, Philadelphia, Pennsylvania.
- NICHOLS, CARROLL B.**, 1214 Widener Building, Philadelphia, Pennsylvania.
- NICHOLS, LEON W.**, Chemist, Glenolden, Pennsylvania.
- NICHOLS, Dr. WILLIAM H.**, Consulting Chemist, Chairman of Board of Directors, The Allied Chemical and Dye Corporation, 61 Broadway, New York City, New York.
- NIGHTINGALE, DONALD ARCHER**, Chemist, Ambler, Pennsylvania.
- NORMAN, BRADFORD**, Farmer, Newport, Rhode Island.
- NORMAN, REGINALD**, Farmer, Newport, Rhode Island.
- NORRIS, GEORGE L.**, Tool Specialist, 222 West 2nd Street, Wilmington Delaware.
- NORTH, R. H.**, North Brothers Manufacturing Company, Lehigh Avenue and American Street, Philadelphia, Pennsylvania.
- NORTHROP, EDWIN FITCH**, Research Physicist, Palmer Physical Laboratory, Princeton, New Jersey.

- NOYES, STEPHEN H.**, Civil Engineer, Bureau of Surveys, City Hall, Philadelphia, Pennsylvania.
- NUTTING, P. G.**, Director of Research, 1644 Irving Street, Washington, D. C.
- OAKLEAF, JAMES FRANCIS**, Chief of Research Laboratories, Vacuum Oil Company, Paulsboro, New Jersey.
- OATLEY, H. B.**, Chief Engineer, Locomotive Superheater Company, 145 Wilson Avenue, Flushing, New York.
- OBERLE, Dr. ALFRED**, Research Chemist, 343 South Oak Park Avenue, Oak Park, Illinois.
- OBERLY, ALBERT D.**, Civil Engineer, Scottsdale, Pennsylvania.
- OERLEIN, KARL F.**, 2943 Cambridge Street, Philadelphia, Pennsylvania.
- OHMER, WILL I.**, President, Recording and Computing Machines Company, Dayton, Ohio.
- OLSEN, THORSTEN Y.**, Vice-President and Treasurer, Tinius Olsen Testing Machine Company, 500 North 12th Street, Philadelphia, Pennsylvania.
- OLSEN, TINIUS**, Mechanical Engineer, 500 North 12th Street, Philadelphia, Pennsylvania.
- ONNES, HEIKE KAMERLINGH**, Physicist, University of Leiden, Leiden, Holland.
- ORROK, GEORGE A.**, Consulting Engineer, 124 East 15th Street, New York City, New York.
- ORTENBLAD, RODOLPHO**, Electrical Engineer, General Electric Company, Schenectady, New York.
- OSBORNE, L. A.**, Vice-President, Westinghouse Electric and Manufacturing Company, 165 Broadway, New York City, New York.
- OTIS, SPENCER**, Manufacturer, Railway Exchange Building, Chicago, Illinois.
- OTT, G. F.**, President, George F. Ott Company, 325 Hansberry Street, Philadelphia, Pennsylvania.
- OUTERBRIDGE, ALEXANDER E., Jr.**, Metallurgist, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- OWEN, BARTRAM ASHMEAD**, Civil Engineer, 411 Pine Street, Philadelphia, Pennsylvania.
- PALMER, Dr. FREDERIC, Jr.**, Professor of Physics, Haverford College, Haverford, Pennsylvania.
- PALMER, T. CHALKLEY**, 2nd Vice-President, American Dyewood Company, and for mail, Chester, Pennsylvania.
- PALMER, WALTER**, Engineer, American Dyewood Company, and for mail, 105 West 23rd Street, Chester, Pennsylvania.
- PARISH, LE GRAND**, President, American Arch Company, Inc., 17 East 42nd Street, New York City, New York.
- PARKER, EDWARD W.**, Statistician and Economist, 437 Chestnut Street, Philadelphia, Pennsylvania.
- PARKER, JOHN C.**, in care of Lefax, Inc., Sheridan Building, Philadelphia, Pennsylvania.
- PARR, S. W.**, Professor of Applied Chemistry, 107 Chemistry Building, Urbana, Illinois.
- PARRISH, THADDEUS ROWLAND**, Standardization Engineer, U. S. Gypsum Company, 205 West Monroe Street, Chicago, Illinois, and for mail, 1036 Randolph Street, Oak Park, Illinois.
- PARSONS, Sir CHARLES A., K.C.B.**, 6 Windsor Terrace, Newcastle-On-Tyne, England.
- PARSONS, Dr. LOUIS ALEXANDER**, Professor of Physics, Gettysburg College, Gettysburg, Pennsylvania.
- PATTERSON, EDWARD B.**, Technical Editor, 42 West Walnut Lane, Merchantville, New Jersey.
- PATTERSON, FRANCIS D.**, Physician, Chief of Division of Industrial Hygiene and Engineering, Department of Labor and Industry, Harrisburg, and for mail, 3500 Grays Ferry Road, Philadelphia, Pennsylvania.
- PATTERSON, J. EDWARD**, Vice-President, Arthur H. Thomas Company, 230 South 7th Street, Philadelphia, Pennsylvania.
- PAUL, H. N.**, Attorney-at-Law, 1815 Land Title Building, Philadelphia, Pennsylvania.
- PAUL, LAWRENCE T.**, Consulting Engineer, 105 Liberty Building, Broad and Chestnut Streets, Philadelphia, Pennsylvania.
- PEACOCK, S.**, Manufacturer of Chemist's Supplies, Wheeling Steel Building, Wheeling, West Virginia.
- PEACOCK, SELINA EMMA**, Organist, 1919 Master Street, Philadelphia, Pennsylvania.
- PEARSON, FREDERICK J.**, 25 East Washington Street, Chicago, Illinois.
- PEARSON, JOSHUA A.**, Purchasing Agent, The United Gas Improvement Company, 1401 Arch Street, Philadelphia, Pennsylvania.
- PEASE, F. N.**, Chief Chemist, Pennsylvania Railroad Company, P. O. Box 503, Altoona, Pennsylvania.
- PEASE, FRANCIS G.**, Astronomical Engineer, Mt. Wilson Solar Observatory, Pasadena, California.
- PECK, G. L.**, Vice-President, Personnel Department Pennsylvania System, Broad Street Station, Philadelphia, Pennsylvania.
- PEEK, FRANK WILLIAM, Jr.**, Consulting and Research Electrical Engineer, General Electric Company, Pittsfield, Massachusetts.
- PEMBERTON, Dr. RALPH**, Physician, 2120 Sansom Street, and for mail, 2122 Sansom Street, Philadelphia, Pennsylvania.
- PENDER, HAROLD**, Professor of Electrical Engineering, Dean, Moore School of Electrical Engineering, University of Pennsylvania, Philadelphia, Pennsylvania.
- PENNOCK, GEORGE L.**, 165 West Essex Avenue, Lansdowne, Pennsylvania.
- PENROSE, CHARLES**, Electrical Engineer, in care of Day and Zimmermann, 1600 Walnut Street, Philadelphia, Pennsylvania.
- PENROSE, R. A. F., Jr.**, Geologist, 460 Bullitt Building, Philadelphia, Pennsylvania.
- PEPPER, DAVID**, Engineer, Commonwealth Building, Philadelphia, Pennsylvania.
- PEROT, T. MORRIS, Jr.**, Malt Manufacturer, 605 Chestnut Street, Philadelphia, Pennsylvania.

- PERROT, EMILE G.**, Architect and Engineer, Boyertown Building, 1211 Arch Street, Philadelphia, Pennsylvania.
- PERRY, ROBERT S.**, President, Franklin H. Kalbfleisch Company, 31 Union Square, West, New York City, New York.
- PERSHING, General JOHN J.**, War Department, Washington, D. C.
- PETERSON, WALTER**, 80 Federal Street, Boston, Massachusetts.
- PEW, J. HOWARD**, President, Sun Oil Company, and Sun Shipbuilding Company, Finance Building, Philadelphia, Pennsylvania.
- PHILIPS, EDWIN S.**, President, Philbrin Corporation, Kennett Square, Pennsylvania.
- PIERCE, G. A.**, Electrical Engineer, Wm. Cramp & Sons Ship and Engine Building Company, Philadelphia, Pennsylvania.
- PITMAN, Brig. General JOHN** (Retired), 611 Berkeley Avenue, Orange, New Jersey.
- PLACE, W. L.**, Architect and Structural Engineer, S. W. Corner 12th and Locust Streets, Philadelphia, Pennsylvania.
- PLATT, H. H.**, Mechanical Engineer, Wallingford, Pennsylvania.
- POND, Dr. SAMUEL ERNEST**, Teacher Research, Medical School, Scott and Euclid Avenues, St. Louis, Missouri.
- POPE, FREDERICK**, Consulting Engineer, 60 Broadway, New York City, New York.
- POPE, RALPH W.**, Honorary Secretary, American Institute of Electrical Engineers, 370 Cherry Street, Elizabeth, New Jersey.
- PORTER, Dr. HORACE C.**, Consulting Chemist and Chemical Engineer, 1833 Chestnut Street, Philadelphia, Pennsylvania.
- PORTER, J. BENTON**, Electrical Engineer, 1527 Spruce Street, Philadelphia, Pennsylvania.
- PORTER, ROLAND G.**, Gas Engineer, Swarthmore, Pennsylvania.
- POSER, Dr. M.**, 16 Vick Park B, Rochester, New York.
- POTTER, ROWLAND S.**, Technical Director and Vice-President, American Photo Products Company, Verona, New Jersey, and for mail, Arlington Avenue, Caldwell, New Jersey.
- POSTLETHWAITE, C. E.**, General Sales Manager, Pressed Steel Car Company, 55 Broad Street, New York City, New York.
- POTTS, JOSHUA R. H.**, Attorney-at-Law, 929 Chestnut Street, Philadelphia, Pennsylvania.
- POTTS, WILLIAM M.**, Civil Engineer, Wyebrooke, Chester County, Pennsylvania.
- POWER, ARCHIE DAYTON**, Physicist, Department of Physics, Lawrence College, Appleton, Wisconsin.
- PRATT, CARL D.**, Chemist, 412 West Broad Street, Tamaqua, Pennsylvania.
- PRICE, MAX CHARLES**, Architect, Punta Gorda, Florida.
- PRICE, MORTON MOORE**, Sales Agent, The Babcock and Wilcox Company, 1010 North American Building, Philadelphia, Pennsylvania.
- PURCELL, JOHN**, Assistant to Vice-President, Atchison, Topeka and Santa Fe Railway Company, 80 East Jackson Boulevard, Chicago, Illinois.
- QUIMBY, HENRY H.**, Consulting Structural Engineer, 4951 Pine Street, Philadelphia, Pennsylvania.
- QUINN, C. H.**, Electrical Engineer, Palace Hotel, San Francisco, California.
- RAFF, ALBERT RAYMOND**, Builder, 1631-35 Thompson Street, Philadelphia, Pennsylvania, and for mail, 1300 Oak Lane Avenue, Philadelphia, Pennsylvania.
- RAMSBURG, C. J.**, Vice-President, The Koppers Company, Pittsburgh, Pennsylvania.
- RAMSEY, GEORGE W.**, Patent Attorney, Woolworth Building, New York City, New York.
- RANGER, RICHARD H.**, Radio Engineer, 66 Broad Street, New York City, New York.
- RAPP, I. M.**, Physicist, R. D. 3, Phoenixville, Pennsylvania.
- RAU, ALBERT GEORGE**, Professor of Mathematics and Dean, Moravian College and Theological Seminary, Bethlehem, Pennsylvania.
- RAUTENSTRAUCH, WALTER**, Vice-President and General Manager, Liberty Yeast Corporation, 56 West 45th Street, New York City, New York.
- RAYMOND, WARD**, Mechanical Engineer, 908 Paxinosa Avenue, Easton, Pennsylvania.
- REA, SAMUEL**, President, Pennsylvania Railroad Company, Broad Street Station, Philadelphia, Pennsylvania.
- REATH, THEODORE W.**, Attorney-at-Law, 1201 Commercial Trust Building, Philadelphia, Pennsylvania.
- REBER, Colonel SAMUEL**, Director Radio Corporation of America, 66 Broad Street, New York City, New York.
- REBMANN, G. R.**, Vice-President, Otis Elevator Company, 16th and Samson Streets, Philadelphia, Pennsylvania.
- REDFIELD, ROBERT S.**, Wayne, Pennsylvania.
- REED, G. HERKELEY**, Inventor, Rowayton, Connecticut.
- REEDER, HOWARD EMERSON**, Civil Engineer, 1204 Sansom Street, and for mail, 542 East Mayland Street, Philadelphia, Pennsylvania.
- REESE, CHARLES L.**, Chemical Engineer, E. I. du Pont de Nemours & Company, Wilmington, Delaware.
- REICHARDT, HENRY** (Retired), 3581 Queen Lane, East Falls, Philadelphia, Pennsylvania.
- REILLY, MARION**, 2015 DeLancey Place, Philadelphia, Pennsylvania.
- RENO, JESSE W.**, Consulting Engineer, 684 St. Nicholas Avenue, New York City, New York.
- REOCH, ALEXANDER ERNEST**, Electrical Engineer, The Radio Corporation of America, 233 Broadway, New York City, New York.
- RESINES, JAVIER**, Industrial Chemist, Racquet Club, Philadelphia, Pennsylvania.
- RHOADS, J. J.**, Superintendent, Pennsylvania Railroad Company, and for mail, Miller Park, Franklin, Pennsylvania.
- RICE, CHARLES D.**, Manager of Factory, Underwood Typewriter Company, 581 Capitol Avenue, Hartford, Connecticut.
- RICE, E. W. Jr.**, Electrical Engineer, President, General Electric Company, Schenectady, New York.

- RICHARDS, HORACE CLARK**, Professor of Mathematical Physics, University of Pennsylvania, and for mail, 4812 Fairmount Avenue, Philadelphia, Pennsylvania.
- RICHARDS, JOHN**, Address unknown.
- RICHARDS, THEODORE WM.**, Director, Wolcott Gibbs Memorial Laboratory, Harvard University, Cambridge, Massachusetts.
- RICHARDSON, CHARLES E.**, Engineer, in care of The Yale Club, 44th Street and Vanderbilt Avenue, New York City, New York.
- RICKETTS, L. D.**, Mining Engineer, Warren, Arizona.
- RIDGWAY, ELLIS B.**, Manufacturer, 367 West Main Street, Coatesville, Pennsylvania.
- RIDGWAY, ROBERT**, Chief Engineer, Board of Transportation, 49 Lafayette Street, New York City, New York.
- RIDGWAY, WILLIAM H.**, Civil Engineer and Manufacturer, The Craig Ridgway and Son Company, Coatesville, Pennsylvania.
- RIEHLE, FREDERICK A.**, President, Riehle Brothers Testing Machine Company, 1424 North 9th Street, Philadelphia, Pennsylvania.
- RIGLING, ALFRED**, Librarian, The Franklin Institute, and for mail, 4835 Haverford Avenue, Philadelphia, Pennsylvania.
- RILEY, LEWIS A.**, Civil and Mining Engineer, Lafayette Building, 437 Chestnut Street, Philadelphia, Pennsylvania.
- RILLIET, CHARLES E.**, Teacher, 4100-06 South Vermont Avenue, Los Angeles, California.
- RINGWALT, ROLAND**, Clergyman, 3016 Carman Street, Camden, New Jersey.
- RITCHIE, KENNETH MONTGOMERY**, Chemist, Armstrong Cork Company, Gloucester, New Jersey.
- RITTER, LOUIS E.**, Consulting Civil Engineer, 1707 Marquette Building, Chicago, Illinois.
- RIITMAN, Dr. W. F.**, Chemical Engineer, Carnegie Institute of Technology, Pittsburgh, Pennsylvania.
- ROBB, RUSSELL**, Member of Firm, Stone and Webster Engineering Corporation, 147 Milk Street, Boston, Massachusetts.
- ROBERTS, CHARLES C.**, Chemist, Arthur H. Thomas Company, Philadelphia, and for mail 75 West La Crosse Avenue, Lansdowne, Pennsylvania.
- ROBINSON, ANTHONY W.**, Insurance, 6 College Avenue, Haverford, Pennsylvania.
- ROBINSON, DWIGHT P.**, Consulting Engineer, Stuyvesant Avenue, Milton Point, Rye, New York.
- ROBINSON, EDMUND G.**, Chemist, 909 Nottingham Road, Wilmington, Delaware.
- ROBINSON, WILLIAM WILSON**, Ship and Yacht Builder, Camden, New Jersey, and for mail, 6446 Sherwood Road, Overbrook, Pennsylvania.
- RODMAN, HUGH**, Engineer and Manufacturer, in care of Rodman Chemical Company, Verona, Pennsylvania.
- RODMAN, Dr. JESSIE A.**, Teacher of Physics, 81 High Street, Germantown, Philadelphia.
- ROESSLER, FRANZ**, Manufacturing Chemist, 89 High Street, Perth Amboy, New Jersey.
- ROGERS, Mrs. AUGENE P.**, 4007 Powelton Avenue, Philadelphia, Pennsylvania.
- ROGERS, FRANK H.**, Mechanical Engineer, William Cramp & Sons, Ship and Engine Building Company, Philadelphia, Pennsylvania.
- ROGERS, JAMES S.**, Attorney-at-Law, 701 Commonwealth Trust Building, Philadelphia, Pennsylvania.
- ROLLE, SYLVAN D.**, Draftsman, The Bell Telephone Company of Pennsylvania, and for mail, 2143 North 19th Street, Philadelphia, Pennsylvania.
- ROLLER, FRANK W.**, Electrical and Mechanical Engineer, 233 Broadway, New York City, New York.
- RONDINELLA, L. F.**, Head of Drawing and Designing, West Philadelphia High School for Boys, 48th and Walnut Streets, Philadelphia, Pennsylvania.
- ROONEY, FREDERICK M.**, The Emil Greiner Company, 55 Fulton Street, New York City, New York.
- ROSENBAUM, MORRIS**, Foreign Exchange, 605 South 3rd Street, Philadelphia, Pennsylvania.
- ROSENBAUM, W. A.**, Patent Attorney, 41 Park Row, New York City, New York.
- ROSENGARTEN, FREDERIC**, Manufacturing Chemist, P. O. Box 1625, Philadelphia, Pennsylvania.
- ROSENGARTEN, Dr. GEORGE D.**, Manufacturing Chemist, P. O. Box 1625, Philadelphia, Pennsylvania.
- ROOSEVELT, NICHOLAS G.**, Vice-President, Day and Zimmermann, Inc., Engineers, 1600 Walnut Street, Philadelphia, Pennsylvania.
- ROSIN, JOSEPH**, Chemist, Powers-Weightman-Rosengarten Company, 9th and Parrish Streets, Philadelphia, Pennsylvania.
- ROSS, T. EDWARD**, Certified Public Accountant, 1209 Morris Building, Philadelphia, Pennsylvania.
- ROTHERMEL, JOHN JACOB**, Teacher of Physics, Eastern High School, 1126 Vermont Avenue, N. W. Washington, D. C.
- ROWLAND, CHARLES B.**, Vice-President, Continental Iron Works, West and Calyer Streets, Brooklyn, New York.
- ROWLAND, THEODORE S.**, Head of Science Department, North East High School, and for mail, 6311 North Camac Street, Philadelphia, Pennsylvania.
- RUGG, W. S.**, The University Club, Natalie Street, Pittsburgh, Pennsylvania.
- RUMBOUGH, JOHN B.**, Consulting Mechanical Engineer, R. F. D. No. 1, Ardan, North Carolina.
- RUMELY, W. N.**, 3020 Sheridan Road, Chicago, Illinois.
- RUSBY, J. M.**, Engineer of Tests, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- RUSSELL, CHARLES J.**, Manager, Sales Department, The Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.

- RUTHERFORD, Sir ERNEST**, Cavendish Professor of Experimental Physics, The University of Cambridge, Cambridge, England.
- RUST, HENRY P.**, Civil Engineer, Manager of Harper and Taylor, Engineers, Bankers Trust Building, Philadelphia, Pennsylvania.
- SADTLER, SAMUEL S.**, Consulting Chemist, 210 South 13th Street, Philadelphia, Pennsylvania.
- SAEGMULLER, G. N.**, Vice-President, in care of Bausch and Lomb Optical Company, Rochester, New York.
- SAFFORD, Dr. FREDERICK HOLLISTER**, Professor of Mathematics, College Hall, University of Pennsylvania, Philadelphia, Pennsylvania.
- SAGEBEER, RICHARD G.**, Teaching Fellow, Haverford College, Haverford, Pennsylvania.
- SALMON, FREDERICK W.**, Civil and Mechanical Engineer, Richmond, Virginia.
- SALOM, PEDRO G.**, Electro-Chemical Engineer, Commonwealth Trust Building, Philadelphia, Pennsylvania.
- SAMUEL, J. BUNFORD**, Retired Iron Merchant, 1609 Spruce Street, Philadelphia, Pennsylvania.
- SANBORN, EDWARD H.**, Coal Mining, 1100 Commercial Trust Building, Philadelphia, Pennsylvania.
- SANDERSON, R. P. C.**, in care of The Baldwin Locomotive Works, 34 Victoria Street, London, England.
- SANDS, BENJAMIN WILEY**, Research Worker, Brunswick, Maryland.
- SANFORD, RUFUS H.**, Librarian, The Baldwin Locomotive Works, Philadelphia, Pennsylvania.
- SANVILLE, HENRY P.**, Engineer, 1015 Chestnut Street, Philadelphia, Pennsylvania.
- SARGENT, C. E.**, Research Engineer, P. O. Box 134, Elgin, Illinois.
- SARGENT, HENRY B.**, Hardware Manufacturer, 247 Church Street, New Haven, Connecticut.
- SARTAIN, PAUL J.**, Physician, 2006 Walnut Street, Philadelphia, Pennsylvania.
- SATTERTHWAITE, GEORGE**, Manufacturer of Steel, in Care of Henry Disston and Sons, Tacony, Philadelphia, Pennsylvania.
- SAUER, FRANK H.**, Draftsman, 1307 Atlantic Avenue, Camden, New Jersey.
- SAUNDERS, LEWIS E.**, Manager of Research Laboratory, Norton Company, and for mail, 262 Salisbury Street, Worcester, Massachusetts.
- SAUNDERS, WALTER M.**, Analytical and Consulting Chemist, 20 Dewey Street, Olneyville, Providence, Rhode Island.
- SAUNDERS, WILLIAM E.**, Librarian, U. G. I. Building, Broad and Arch Streets, Philadelphia, Pennsylvania.
- SAWTELLE, WILLIAM OTIS**, Professor of Physics, Haverford College, Haverford, Pennsylvania.
- SCANNELL, GERALD EDWARD**, Experimental Machinist, 3123 Tulip Street, Philadelphia, Pennsylvania.
- SCHERL, OSCAR L.**, Mechanical Engineer, 1631 Girard Avenue, Philadelphia, Pennsylvania.
- SCHLAFGE, WILLIAM S.**, General Mechanical Superintendent, Erie Railroad Company, 50 Church Street, New York City, New York.
- SCHLICK, C. P.**, Treasurer and Secretary, 191 Berkeley Place, Brooklyn, New York.
- SCHROM, OSCAR G.**, Mechanical Engineer, 6017 Nassau Street, Philadelphia, Pennsylvania.
- SCOTT, WM. M.**, Draftsman, Box 76, Radnor, Pennsylvania.
- SEELY, LESLIE B.**, Teacher, 5918 Pulasqui Avenue, Germantown, Philadelphia, Pennsylvania.
- SELGA, M.**, Meteorologist and Astronomer, Manila Observatory, Manila, Philippine Islands.
- SELLERS, ALEXANDER**, Manufacturer, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- SELLERS, COLEMAN, 3rd**, Mechanical Engineer, Wm. Sellers & Company, Inc., 1600 Hamilton Street, Philadelphia, Pennsylvania.
- SELLERS, HORACE W.**, Architect, Ardmore, Pennsylvania.
- SELLERS, HOWARD**, Millbourne House, Millbourne, Pennsylvania.
- SELLERS, RICHARD**, Bellevue, Delaware.
- SELLERS, RICHARD C.**, Civil Engineer, Swarthmore, Pennsylvania.
- SELLERS, Mrs. WILLIAM**, Bellevue, Delaware.
- SELLERS, WILLIAM F.**, Manufacturer of Water Tube Boilers, Edge Moor, Delaware.
- SENER, RALPH TOWNSEND**, Vice-President, Engineering, Mitten Management, Inc., 1520 Spruce Street, Philadelphia, Pennsylvania.
- SEVERY, MELVIN L.**, Inventor and Author, 431 South Berendo Street, Los Angeles, California.
- SHACKELFORD, BENJAMIN E.**, Physicist, Westinghouse Lamp Company, Bloomfield, New Jersey.
- SHAND, A. C.**, Civil Engineer, Narberth, Pennsylvania.
- SHARP, Dr. CLAYTON H.**, Technical Director, Electrical Testing Laboratories, 80th Street and East End Avenue, New York City, New York.
- SHATTUCK, A. F.**, Chief Chemist, Solvay Process Company, and for mail, 614 Canon Drive, Beverly Hills, California.
- SHATTUCK, JOHN D.**, Gas Engineer, Chester, Pennsylvania.
- SHAW, A. NORMAN**, Associate Professor of Physics, McGill University, Montreal, Canada.
- SHIMER, PORTER W.**, Chemist and Metallurgist, Easton, Pennsylvania.
- SHMIDHEISER, W. A.**, Mechanical Engineer, The Bell Telephone Company of Pennsylvania, and for mail, 6017 Pine Street, Philadelphia, Pennsylvania.
- SHOBER, SAMUEL L.**, Special Representative, Union Switch and Signal Company, and for mail, Rittenhouse Club, 1811 Walnut Street, Philadelphia, Pa.
- SHOEMAKER, SAMUEL**, Builder and Real Estate, 1214-15 Franklin Trust Building, 1500 Chestnut Street, Philadelphia, Pennsylvania.
- SHOEMAKER, THOMAS H.** (Retired), 120 West Tulpehocken Street, Germantown, Philadelphia, Pennsylvania.
- SHRADER, J. E.**, Professor of Physics, Drexel Institute, Philadelphia, Pennsylvania.
- SEIG, Dr. LEE PAUL**, Professor of Physics, University of Pittsburgh, Pittsburgh, Pennsylvania.

- SILCOX, LEWIS K.**, Mechanical and Electrical Engineer, Herrick Road, Box 579, Riverside, Illinois.
- SIMS, Rear Admiral WILLIAM S.**, U. S. N., 77 Rhode Island Avenue, Newport, Rhode Island.
- SIMSOHN, JULIAN STERN**, Chemist, S. E. corner Broad Street and Girard Avenue, Philadelphia, Pennsylvania.
- SINKLER, JOHN P. B.**, Architect, 412 Otis Building, 112 South 16th Street, Philadelphia, Pennsylvania.
- SKINNER, C. E.**, Engineer, Research Division, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania.
- SKINNER, H. J.**, President, Skinner, Sherman and Esselen, Inc., Industrial Chemists, 276 Stuart Street, Boston, Massachusetts, and for mail, 71 West Chestnut Street, Wakefield, Massachusetts.
- SKINNER, ORVILLE CAMPBELL**, Metallurgical Engineer, Superintendent, Standard Steel Works, Burnham, Pennsylvania.
- SLATER, HOWARD C.**, Mechanical Engineer, 102 Remsen Street, Brooklyn, New York.
- SMALLING, ELMER, Jr.**, Student, 2939 North Camac Street, Philadelphia, Pennsylvania.
- SMITH, A. D. W.**, Mining Engineer, 1732 Commercial Trust Building, Philadelphia, Pennsylvania.
- SMITH, ALBERT W.**, Professor of Industrial Chemistry, Case School of Applied Science, and for mail, 11333 Bellflower Road, Cleveland, Ohio.
- SMITH, A. T.**, in care of The Permutit Company, 440 Fourth Avenue, New York City, New York.
- SMITH, AUGUSTUS**, Civil Engineer, Elizabeth, R. F. D. No. 2, New Jersey.
- SMITH, EDWARD W.**, Chemical Engineer, 535 Church Lane, Germantown, Philadelphia, Pennsylvania.
- SMITH, ELMER A.**, Consulting Electrical Engineer, 596 Columbia Avenue, and for mail, 232 Garden Street, Hoboken, New Jersey.
- SMITH, FRANK W.**, Vice-President and General Manager, The United Electric Light and Power Company, 130 East 15th Street, New York City, New York.
- SMITH, HASELTINE**, Insurance Broker, 326 Walnut Street, Philadelphia, Pennsylvania.
- SMITH, HERBERT S. S.**, Professor of Civil Engineering, 205 Wallace Street, Stroudsburg, Pennsylvania.
- SMITH, IOWA**, Commercial Engineer, International Telephone Company, Clinton Building, Columbus, Ohio.
- SMITH, IRVING B.**, Chief of Research Department, Leeds and Northrup Company, and for mail, Ambler, Pennsylvania.
- SMITH, J. WALDO**, Consulting Engineer, Board of Water Supply, City of New York, Municipal Building, New York City, New York.
- SMITH, N. W.**, Pennsylvania Railroad Company, Room 372, Broad Street Station, Philadelphia, Pennsylvania.
- SMITH, OBERLIN**, Mechanical Engineer and Manufacturer, in care of Ferracute Machine Company, Bridgeton, New Jersey.
- SMITH, P. F., Jr.**, Manager, Altoona Works, Pennsylvania System, Altoona, Pennsylvania.
- SMITH, S. D.**, Machinist, 1616 North Redfield Street, Philadelphia, Pennsylvania.
- SMITH, WALTER B.**, Builder, 6490 Woodbine Avenue, Overbrook, Philadelphia, Pennsylvania.
- SMITH, W. HINCKLE**, Banker, Bryn Mawr, Pennsylvania.
- SMITH, W. LEIGH**, Chemist, The Viscose Company, Box 171, Marcus Hook, Pennsylvania.
- SNARE, FREDERICK**, Contracting Engineer, 114 Liberty Street, New York City, New York.
- SNELLING, WALTER O.**, Research Chemist, 110 South 13th Street, Allentown, Pennsylvania.
- SNOOK, H. CLYDE**, Electrical Engineer, c/o Western Electric Company, 463 West Street, New York City, New York.
- SNYDER, CLINTON F.**, Chemist, Minersville, Pennsylvania.
- SNYDER, Professor MONROE B.**, Teacher and Astronomer, 111 Grand View Road, Ardmore, Pennsylvania.
- SONODA, S.**, Knida 15, Inari, near Kyoto, Japan.
- SOUTHALL, JAMES P. C.**, Professor of Physics, Columbia University, New York City, New York.
- SPACKMAN, Lieut.-Col. H. S.**, Egypt Mills Post Office, Pike County, Pennsylvania.
- SPENCER, H. B.**, President, Fruit Growers' Express Company, Munsey Building, Washington, D. C.
- SPENCER, PAUL**, Electrical Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- SPENCER, THOMAS**, Engineer, 3523 Balsam Avenue, Indianapolis, Indiana.
- SPERR, F. W., Jr.**, Chief Chemist, The H. Koppers Company, Laboratory, Mellon Institute, Pittsburgh, Pennsylvania.
- SPERRY, ELMER A.**, Engineer, The Sperry Gyroscope Company, Sperry Building, Manhattan Bridge Plaza, Brooklyn, New York.
- SPICER, H. N.**, Metallurgical Engineer, The Architects Building, 247 Park Avenue, New York City, New York.
- SPITZ, SAMUEL**, Inventor, 2244 North Van Pelt St., Philadelphia, Pennsylvania.
- SPITZGLASS, J. M.**, Mechanical Engineer, 2240 Diversey Boulevard, Chicago, Illinois.
- SPRAGUE, FRANK J.**, Consulting Engineer, President, Sprague Safety Control and Signal Corporation, 421 Canal Street, New York City, New York.
- SPRONG, S. D.**, Electrical Engineer, Room 505, 15 Moore Street, New York City, New York.
- SPROUL, Hon. WM. C.**, Manufacturer, 117 South Sixteenth Street, Philadelphia, Pennsylvania.
- SPRUANCE, W. C.**, Vice-President, in Charge of Production Department, E. I. du Pont de Nemours and Company, and for mail, 2507 West 17th Street, Wilmington, Delaware.

- SQUIER, Major General GEORGE OWEN, K. C. M. G., D. S. C., War Department, Washington, D. C.**
- ST. CLAIR, WILLIAM, 2345 North Carlisle Street, Philadelphia, Pennsylvania.**
- ST. JOHN, ANCEL, Consulting Physicist, Room 404, 505 Fifth Avenue, New York City, and for mail, 17 Hix Avenue, Rye, New York.**
- STANFORD, Captain H. E., Civil Engineer (C. E. C.), U. S. N., Bureau of Yards and Docks, Navy Department, Washington, D. C.**
- STEEL, JOSEPH M., Building Constructor, 1600 Arch Street, Philadelphia, Pennsylvania.**
- STEINER, OSCAR, Mechanician, Bartol Research Foundation of The Franklin Institute, 127 North 19th Street, Philadelphia, Pennsylvania, and for mail, 131 North 19th Street, Philadelphia, Pennsylvania.**
- STEINMETZ, JOSEPH ALLISON, Designer, Janney, Steinmetz and Company, 1421 Chestnut Street, Philadelphia, Pennsylvania.**
- STUBER, HENRY J., Chemist, 115 Beverly Road, Montclair, New Jersey.**
- STEVENS, JOHN S., 9th Street and Montgomery Avenue, Philadelphia, Pennsylvania.**
- STEVENSON, Dr. A. E. Jr., Electrical Engineer, General Electric Company, 6 Union Street, Schenectady, New York.**
- STEVENSON, S. PRICE, Manufacturer of Cold Storage Doors, 1500 West 4th Street, Chester, Pennsylvania.**
- STEWART, FRANK H., Dealer in Electrical Supplies, Old Mint Building, Philadelphia, Pennsylvania.**
- STEWART, FRANK H., 4416 North 15th Street, Philadelphia, Pennsylvania.**
- STEWART, RALPH C., Attorney-at-Law, Sydenham Building, 1512 Walnut Street, Philadelphia, Pennsylvania.**
- STEWART, THOMAS S., Physician, 1532 Pine Street, Philadelphia, Pennsylvania.**
- STILLWELL, L. B., Consulting Engineer, 90 West Street, New York City, New York.**
- STINE, WILBUR M., Author, 3932 Haverford Avenue, Philadelphia, Pennsylvania.**
- STOETZ, HOWARD, Research Chemist, Electric Storage Battery Company, and for mail, 4741 Rosehill Street, Philadelphia, Pennsylvania.**
- STOKES, FRANCIS J., Machinery Manufacturer, 17th and Cambria Streets, Philadelphia, Pennsylvania.**
- STOKLEY, JAMES, Student, in care of Science Service, B and 21st Streets, N. W., Washington, D. C.**
- STONE, C. W., Electrical Engineer, General Electric Company, Schenectady, New York.**
- STONE, JOHN STONE, Consulting Electrical Engineer, 3942 Alameda Street, San Diego, California.**
- STOTESBURY, E. T., Banker, Chestnut and 5th Streets, Philadelphia, Pennsylvania.**
- STOUGHTON, A. B., Attorney-at-Law, 1506 Land Title Building, Philadelphia, Pennsylvania.**
- STOUT, ORIN C., Industrial Engineer, 207 Commerce Building, Columbus, Ohio.**
- STRADLING, Dr. G. F., Teacher, Principal Northeast High School, and for mail, 5120 Newhall Street, Germantown, Philadelphia, Pennsylvania.**
- STRONG, WILLIAM WALKER, Consulting Physicist, 500 South York Street, Mechanicsburg, Cumberland County, Pennsylvania.**
- STROUD, EDWARD A., Florist, 508 South 41st Street, Philadelphia, Pennsylvania.**
- STUTZ, ERNEST, Representative for Foreign Patents, 1705 Hope Street, South Pasadena, California.**
- STYRI, Dr. HAAKON, Chief Chemist, S. H. F. Research Laboratory, Front Street and Erie Avenue, Philadelphia, Pennsylvania.**
- SULZNER, CHARLES F. (Retired), 131 N. E. Second Street, Miami, Florida.**
- SUPPLEE, WM. H., Factory Manager, The S. S. White Dental Manufacturing Company, Unity and Oakland Streets, Frankford, Philadelphia, Pennsylvania.**
- SUTTON, FRANK W., Industrial Engineer, Box 26, San Diego, California.**
- SUYDAM, V. A., Professor of Physics and Head of Physics Department, Beloit College, and for mail, 1126 Porter Avenue, Beloit, Wisconsin.**
- SWENSON, MAGNUS, President and Treasurer, Southern Wisconsin Power Company, Madison, Wisconsin.**
- SYKES, JOHN P., The Baldwin Locomotive Works, Broad and Spring Garden Streets, Philadelphia, Pennsylvania.**
- SYMONS, J. E., Mechanical Engineer, 77 Davis Street, Westville, New Haven, Connecticut.**
- SYNNESTVEDT, ARTHUR, Student, Bryn Athyn, Pennsylvania.**
- TABER, GEORGE H., Vice-President, Gulf Refining Company, P. O. Box 1214 Pittsburg, Pennsylvania.**
- TAGGART, WALTER T., Professor of Chemistry, University of Pennsylvania, Philadelphia, Pennsylvania.**
- TAIT, EDWARD H., Superintendent, 401 Brighter Apartments, Second and Penn Streets, Reading, Pennsylvania.**
- TAIT, F. M., Callahan Bank Building, Dayton, Ohio.**
- TALBOT, H. P., Professor of Inorganic Chemistry, Massachusetts Institute of Technology, Cambridge, Massachusetts.**
- TANBERG, Dr. ARTHUR P., Chemist, E. I. du Pont de Nemours & Company, Henry Clay, Delaware.**
- TATE, ALFRED O., President, Tate Electrolytic Textile Processes, Incorporated, 32 St. James Street, London, S. W. I., England.**
- TATNALL, Dr. ROBERT R., Research Engineer, J. E. Rhoads and Sons, Wilmington, Delaware.**
- TAYLOR, DAVID WATSON, Rear Admiral, U. S. N., 1813 19th Street N. W., Washington, D. C.**
- TAYLOR, H. BIRCHARD, President, Harper and Taylor, Inc., Bankers Trust Building, Philadelphia, Pennsylvania.**
- TAYLOR, HOLLINSHEAD N., Tinsplate Manufacturer, 300 Chestnut Street, Philadelphia, Pennsylvania.**
- TAYLOR, LOWNDES, Box 3, Route 1, West Chester, Pennsylvania.**

- TEEPLE, Dr. JOHN E., Consulting Chemist and Chemical Engineer, 50 East 41st Street, New York City, New York.
- TEMPLE, EDWARD B., Swarthmore, Pennsylvania.
- THAMM, CHARLES G. A., Clerk, 847 Levick Street, Lawndale, Philadelphia, Pennsylvania.
- THOMAS, ARTHUR H., Laboratory Appliances, West Washington Square, Philadelphia, Pennsylvania.
- THOMAS, C. C., Professor of Mechanical Engineering, 1111 Hollingsworth Building, Los Angeles, California.
- THOMAS, L. E., President, Reading Iron Company, Reading, Pennsylvania.
- THOMPSON, ARTHUR W., President, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.
- THOMPSON, FRANCIS DuPONT, Engineer, 241 East Main Street, Elkton, Maryland.
- THOMPSON, HUGH L., Consulting Engineer, Waterbury, Connecticut.
- THOMPSON, PAUL, N. W. cor. Broad and Arch Streets, Philadelphia, Pennsylvania.
- THOMSON, Professor ELIHU, Electrical Engineer, 22 Monument Avenue, Swampscott, Massachusetts.
- THOMSON, Str JOSEPH J., Trinity College, Cambridge, England.
- THORNE, WILLIAM H., Mechanical Engineer, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- THUROW, WILLIAM HERMAN, Electrical Engineer, 30 M llerstr, Berlin N. 65, Germany.
- THWING, Dr. CHAS. BURTON, 3339 Lancaster Avenue, Philadelphia, Pennsylvania.
- TIDDY, WILLIAM, Chief Chemist, Rainey-Wood Coke Company, Swedeland, Pennsylvania.
- TIEMANN, HUGH P., Metallurgical Engineer, Carnegie Steel Company, Pittsburgh, Pennsylvania.
- TIKHONOVITCH, BENEDICT, Electrical Engineer, The New York Edison Company, 130 East 15th Street, and for mail, 201 West 109th Street, New York City, New York.
- TILGHMAN, B. C., "The Hermitage" near Centreville, Queen Ann County, Maryland.
- TILY, HERBERT JAMES, Merchant, Strawbridge and Clothier, Market and Eighth Street, Philadelphia, Pennsylvania.
- TITZEL, R. JOHN, Gas Engineer, 6 Radnor Road, Radnor, Pennsylvania.
- TOCH, Dr. MAXIMILIAN, Paint Manufacturer, Director, Research Laboratories, Toch Brothers, 110 East 42nd Street, New York City, New York.
- TORCHIO, PHILIP, Chief Electrical Engineer, The New York Edison Company, Irving Place and 15th Street, New York City, New York.
- TOULMIN, H. A., Jr., Patent Attorney, 901 Schwind Building, Dayton, Ohio.
- TOWNEND, R. V., Research Chemist, Victor Talking Machine Company, Camden, New Jersey.
- TOWNSEND, JOHN SEALY, Professor of Physics, New College, Oxford, England.
- TOWNSEND, J. W., 825 Montgomery Avenue, Bryn Mawr, Pennsylvania.
- TRAUTWINE, JOHN C., 3rd, Civil Engineer, 331 West Front Street, Media, Pennsylvania.
- TRENCH, W. W., The General Electric Company, Schenectady, New York.
- TREXLER, Colonel HARRY C., President, Lehigh Portland Cement Company, Allentown, Pennsylvania.
- TROWBRIDGE, Professor AUGUSTUS, Teacher, Princeton University, Princeton, New Jersey.
- TRUE, RODNEY H., Professor of Botany, University of Pennsylvania, Philadelphia, Pennsylvania.
- TRUEMAN, WILLIAM H., Dentist, 47 High Street, Germantown, Philadelphia, Pennsylvania.
- TURNER, O. A., Address Unknown.
- TUTTLE, E. B., Engineer of Transmission and Protection, Bell Telephone Company of Pennsylvania, 261 North Broad Street, Philadelphia, Pennsylvania.
- TUTTLE, WM. C., Manager of Trust Investments, Girard Trust Company, Philadelphia, Pennsylvania.
- TUTWILER, C. C., Consulting Gas Chemist, West Conshohocken, Pennsylvania.
- TYLER, SYDNEY F., Land Title Building, Philadelphia, Pennsylvania.
- TYSON, H. P., Collegeville, Pennsylvania.
- UEHLING, E. A., Mechanical Engineer, 3226 McKinley Building, Milwaukee, Wisconsin.
- ULMER, CARL D., Chemist, The Koppers Company, 1329 Peoples Gas Building, Chicago, Illinois.
- UNDERWOOD, FREDERICK D., President, Erie Railroad Company, 50 Church Street, New York City, New York.
- UNWIN, WILLIAM CAWTHORNE, Civil Engineer, Palace Gate Mansions, Kensington, London, England.
- UMSTEAD, C. H., Civil Engineer, Post Office Building, Cambridge, Massachusetts.
- VAIL, JAMES G., Chief Chemist, Philadelphia Quartz Company, 121 South 3rd Street, Philadelphia, Pennsylvania.
- VAN DER LINGEN, J. STEPHEN, Lecturer, Department of Applied Mathematics, University of Cape Town, Cape Town, South Africa.
- VAN DEVENTER, CHRISTOPHER, Consulting Engineer, 438 First National Bank Building, Chicago, Illinois.
- VAN DEVENTER, H. R., Engineer and Patent Attorney, Dubilier Condenser and Radio Corporation, 48 West Fourth Street, New York City, New York.
- VAN DYKE, J. W., President, The Atlantic Refining Company, and for mail, The Wellington, Philadelphia, Pennsylvania.
- VAN TRUMP, S. N., Civil Engineer, Water Department, Wilmington, Delaware.
- VAUCLAIN, S. M., President, The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- VAUGHAN, H. H., Engineer, 285 Beaver Hall Hill, Montreal, P. Q., Canada.
- VAUGHEN, F. G., Manager, Meter Department, General Electric Company, Schenectady, New York.

- VAUX, GEORGE, Jr.**, Attorney-at-Law, Gulf Road, Bryn Mawr, Pennsylvania.
- VEEDER, CURTIS H.**, Manufacturer, Veeder Manufacturing Company, Hartford, Connecticut.
- VIALL, ETHAN**, 7474 Lower River Road, Fernbank, Cincinnati, Ohio.
- VOGDES, FRANCIS B.**, Research Worker, Research Laboratory, General Electric Company, Schenectady, New York.
- VOGDES, JOSEPH JOHNSON**, 310 Commercial Trust Building, Philadelphia, Pennsylvania.
- VOGLESON, JOHN A.**, Civil Engineer, 8009 Crefeldt Street, Philadelphia, Pennsylvania.
- VOLLRATH, ALFRED J.**, 158 Carpenter Lane, Germantown, Philadelphia, Pennsylvania.
- VREELAND, FREDERICK R.**, Research Engineer, 90 West Street, New York City, New York.
- WADDELL, J. A. L.**, Consulting Engineer, 35 Nassau Street, New York City, New York.
- WADLEIGH, FRANCIS R.**, 1 Broadway, New York City, New York.
- WADSWORTH, F. L. O.**, Consulting and Advisory Engineer, P. O. Box 268, East Liberty Station, Pittsburgh, Pennsylvania.
- WAGNER, FRED H.**, Chief Engineer, The Bartlett Hayward Company, and for mail, Tuscany Apartments, 39th Street and Stony Run Lane, Baltimore, Maryland.
- WAGNER, HERBERT A.**, President, Consolidated Gas, Electric Light and Power Company, Lexington and Liberty Streets, Baltimore, Maryland.
- WAGNER, JOHN**, Merchant, "Four Oaks" School House Lane, Germantown, Philadelphia, Pennsylvania.
- WAGNER, SAMUEL T.**, Chief Engineer, Philadelphia and Reading Railway Company, and for mail, School House Lane, Germantown, Philadelphia, Pennsylvania.
- WAGNER, TOBIAS**, E. Willow Grove Avenue, Chestnut Hill, Philadelphia, Pennsylvania.
- WAGNER, WALTER C.**, Electrical Engineer, Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania, and for mail, 149 Grandview Road, Ardmore, Pennsylvania.
- WALDRON, WILLIAM H.**, Manufacturer of Machinery, John Waldron Company, New Brunswick, New Jersey.
- WALKER, J. W.**, Manufacturer, Devon, Pennsylvania.
- WALLER, ALFRED E.**, Electrical Engineer, Lawrence Park, Bronxville, New York.
- WALLERSTEIN, LEO**, Chemist, 171 Madison Avenue, New York City, New York.
- WALLIS, J. T.**, Chief of Motive Power, Pennsylvania System, Broad Street Station, Philadelphia, Pennsylvania.
- WALTON, HORACE**, Insurance, 416-420 Walnut Street, Philadelphia, Pennsylvania.
- WARDEN, WILLIAM G.**, 1012 Witherspoon Building, Philadelphia, Pennsylvania.
- WARNER, WILLIAM R., Jr.** (Retired), Union League, Broad and Sansom Streets, Philadelphia, Pennsylvania.
- WARNOCK, JAMES, Jr.**, Banker, 333 Chestnut Street, Philadelphia, Pennsylvania.
- WARRINER, S. D.**, President Lehigh Coal and Navigation Company, 437 Chestnut Street, Philadelphia, Pennsylvania.
- WATSON, JAMES**, Steam Specialty Manufacturer, 146 North 7th Street, Philadelphia, Pennsylvania.
- WEATHERWAX, JAMES LLOYD**, Physicist, Philadelphia General Hospital, 34th and Pine Streets, and for mail, 932 North 65th Street, Philadelphia, Pennsylvania.
- WEBSTER, ALBERT L.**, Consulting Sanitary Engineer, 112 E. 40th Street, New York City, New York.
- WEBSTER, GEORGE S.**, Civil Engineer, 4900 Penn Street, Frankford, Philadelphia, Pennsylvania.
- WEBSTER, WM. R.**, Consulting and Inspecting Engineer, 3818 Chestnut Street, Philadelphia, Pennsylvania.
- WEEKS, EDWIN R.**, Consulting Engineer, 505 New Nelson Building, Kansas City, Missouri.
- WEIDLEIN, EDWARD R.**, Chemical Engineer, Director of Mellon Institute of Industrial Research, Pittsburgh, Pennsylvania.
- WEINBERG, SOLOMON**, Chemical Engineer, Research Laboratory, 2027 Arch Street, and for mail, 1913 Arch Street, Philadelphia, Pennsylvania.
- WEISS, J. M.**, 210 West 110th Street, New York City, New York.
- WEILES, HOWARD W.**, Mechanical Engineer, Commercial Truck Company, Philadelphia, Pennsylvania.
- WELLS, G. A.**, 74 South Munn Avenue, East Orange, New Jersey.
- WELLS, W. F.**, Vice-President, Edison Electric Illuminating Company, 360 Pearl Street, Brooklyn, New York.
- WELSH, FRANCIS RALSTON**, Investments, Devon, Pennsylvania.
- WELTZ, EARL H.**, Chemist, 1311 South 52nd Street, Philadelphia, Pennsylvania.
- WENDT, Dr. HAROLD L.**, State College, Pennsylvania.
- WESTON, Dr. EDWARD**, President, Weston Electrical Instrument Company, Waverly Park, Newark, New Jersey.
- WESTON, F. W.**, Manufacturer, Wynnewood, Pennsylvania.
- WETHERILL, HENRY EMERSON**, Physician, Scientist, Inventor, R. D. No. 1, Phoenixville, Pennsylvania.
- WETHERILL, ROBERT**, Engine and Machine Work Manufacturer, Chester, Pennsylvania.
- WETHERILL, S. P.**, Manufacturer, Room 600, Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- WETHERILL, W. CHATTIN**, Department of Mechanical Engineering, University of Pennsylvania, Philadelphia, Pennsylvania.
- WEYL, CHARLES N.**, 255 Harvey Street, Germantown, Philadelphia, Pennsylvania.
- WHARTON, HENRY**, Chestnut Hill, Philadelphia, Pennsylvania.
- WHITAKER, JAMES L.**, Cotton Manufacturer, Cedar Grove, Olney, Philadelphia, Pennsylvania.
- WHITF, A. RAYMOND**, Research Physicist, H. M. Byllesby and Company, 11443 Union Avenue, Chicago, Illinois.

- WHITE, J. ATWOOD**, Paper Machinery Manufacturer, 15th Street and Lehigh Avenue, Philadelphia, Pennsylvania.
- WHITE, W. M.**, Hydraulic Engineer, Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin.
- WHITNEY, ASA W.**, Metallurgist, in care of Enterprise Foundry and Machine Works, Bristol, Tennessee.
- WHITNEY, CHARLES H.**, Whitney-MacDonald Company, Tioga and Memphis Streets, Philadelphia, Pennsylvania.
- WHITNEY, E. R.**, President, Commercial Truck Company, Hunting Park and Rising Sun Avenues, Philadelphia, Pennsylvania.
- WHITNEY, FRANK E.**, Mechanical Engineer, 6653 Lawnton Avenue, Oak Lane, Philadelphia, Pennsylvania.
- WHITNEY, LOUIS B.**, Manager, Alpha Portland Cement Company, 428 Oliver Building, Pittsburgh, Pennsylvania.
- WHYTE, F. M.**, 14 Benedict Avenue, Tarrytown, New York.
- WIDDICOMBE, Major R. A.**, Engineer, 4639 Beacon Street, Chicago, Illinois.
- WIDMYER, JOHN HENRY**, Metallographist, Lancaster Steel Products Corporation, 15 North Lime Street, Lancaster, Pennsylvania.
- WIEGAND, JOHN**, Salesman, 2020 North Marshall Street, Philadelphia, Pennsylvania.
- WILBUR, W. A.**, Banker, South Bethlehem, Pennsylvania.
- WILEY, Dr. H. W.**, Chemist, Room 1120, Woodward Building, Washington, D. C.
- WILKIN, JOHN T.**, President and Engineer, The Connersville Blower Company, and for mail, 905 Grand Avenue, Connersville, Indiana.
- WILLCOX, JAMES M.**, Wawa, Delaware County, Pennsylvania.
- WILLCOX, W. F.**, Darling Post Office, Delaware County, Pennsylvania.
- WILLE, H. V.**, Vice-President, The Baldwin Locomotive Works, The Standard Steel Works Company, 500 North Broad Street, Philadelphia, Pennsylvania.
- WILLIAMS, ALFRED L. W.**, Engineer, 59 West 68th Street, New York City, New York.
- WILLIAMS, E. D.**, Attorney-at-Law, 560 Drexel Building, Philadelphia, Pennsylvania.
- WILLIAMS, IRA JEWELL**, Attorney-at-Law, 1005 Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- WILLIAMS, Dr. WILLIAM J.**, Chemist, 1208 Haworth Street, Frankford, Philadelphia, Pennsylvania.
- WILLIAMSON, J. D., Jr.**, Vice-President, American Engineering Company, Latham Park, Oak Lane, P. O., Philadelphia, Pennsylvania.
- WILSON, ALEXANDER, 3rd.**, Mechanical Engineer, 108 West Baltimore Avenue, Lansdowne, Pennsylvania.
- WILSON, ARTHUR M.**, Insurance, 434 Walnut Street, Philadelphia, Pennsylvania.
- WILSON, H. A.**, Coronado Apartments, 22nd and Chestnut Streets, Philadelphia, Pennsylvania.
- WILSON, H. D.**, Coronado Apartments, 22nd and Chestnut Streets, Philadelphia, Pennsylvania.
- WILSON, HENRY W.**, Civil Engineer, 909 Clinton Street, Philadelphia, Pennsylvania.
- WILSON, JAMES E.**, 910 South 49th Street, Philadelphia, Pennsylvania.
- WILSON, J. HUNT**, Professor of Chemistry, Lafayette College, 531 Cattell Street, Easton, Pennsylvania.
- WILSON, J. L.**, Hotel Idlewild, Media, Pennsylvania.
- WILSON, JOHN S.**, Inspector, 124 South Eutaw Street, Baltimore, Maryland.
- WILSON, Dr. WILLIAM**, Engineer, American Telephone and Telegraph Company, 195 Broadway, New York City, and for mail, 22 Beach Place, Maplewood, New Jersey.
- WOLF, DANIEL DORSEY**, Treasurer, C. C. Kampton & Son, 527 Vine Street, Philadelphia, Pennsylvania.
- WOLF, JOHN JACOB**, 927 North 5th Street, Philadelphia, Pennsylvania.
- WOOD, ALAN, 3rd.**, Mechanical Engineer, 109 County Line, Bryn Mawr, Pennsylvania.
- WOOD, ALBERT C.**, Consulting Mechanical Engineer, Stock Exchange Building, Philadelphia, Pennsylvania.
- WOOD, BIDDLE**, Iron Manufacturer, Conshohocken, Pennsylvania.
- WOOD, E. R., Jr.**, Mechanical Engineer, 409 Chestnut Street, Philadelphia, Pennsylvania.
- WOOD, F. W.**, President, Maryland Steel Company, and for mail, Keyworth Avenue, Baltimore, Maryland.
- WOOD, ROBERT L.**, Civil Engineer, Erdenheim Post Office, Montgomery County, Pennsylvania.
- WOOD, WALTER**, Manufacturer, 400 Chestnut Street, Philadelphia, Pennsylvania.
- WOODBIDGE, J. LFSTER**, Electrical Engineer, 19th Street and Allegheny Avenue, Philadelphia, Pennsylvania.
- WOODBURY, C. A.**, Director, Eastern Laboratory, E. I. du Pont de Nemours Company, Drawer 424, Chester, Pennsylvania.
- WOODHOUSE, HENRY**, Editor, Foster Building, Madison Avenue and 40th Street, New York City, New York.
- WOODLE, ALLAN SHELDON, Jr.**, Engineer, The Baldwin Locomotive Works, Philadelphia, and for mail, Ridley Park, Pennsylvania.
- WOODROFFE, G. H.**, Mechanical and Metallurgical Engineer, Parkesburg, Chester County, Pennsylvania.
- WOODWARD, GEORGE**, Physician, 708 North American Building, Philadelphia, Pennsylvania.
- WOOLMAN, EDWARD**, Mechanical Engineer, N. W. cor. Buck and Panmure Roads, Haverford, Pennsylvania.
- WORRELL, HOWARD SELLERS**, Engineer, 100 East Montgomery Avenue, Ardmore, Pennsylvania.
- WRIGHT, FRANK L.**, Factory Metallurgist, Atlas Ball Company, 4th Street and Glenwood Avenue, Philadelphia, Pennsylvania.

- WRIGHT, JAMES A.**, Wright-Fisher Engineering Company, 600 McGill Building, Montreal, Quebec, Canada.
- WRIGHT, ORVILLE**, Aeronautical Research Engineer, 15 North Broadway, Dayton, Ohio.
- WRIGHT, ROY V.**, Editor, in care of *Railway Age*, 30 Church Street, New York City, New York.
- WRIGHT, WINTHROP R.**, Professor of Physics, Swarthmore College, and for mail, 4 Whittier Place, Swarthmore, Pennsylvania.
- WYATT, JAMES H.**, Electrical Engineer, Cutter Electric and Manufacturing Company, 19th and Hamilton Streets, Philadelphia, Pennsylvania.
- WYETH, F. H.**, Address Unknown.
- YARNALL, D. ROBERT**, Mechanical Engineer, Chestnut Hill, Philadelphia, Pennsylvania.
- YEOMANS, LUCIEN I.**, Industrial Engineer, President, Lucien I. Yeomans, Incorporated, 53 West Jackson Boulevard, Chicago, Illinois.
- YORK, H. W.**, Consulting Engineer, 120 Broadway, New York City, New York.
- YORKE, GEORGE M.**, Engineer, 195 Broadway, New York City, New York.
- YOUNG, J. BERTRAM**, Chemist, Philadelphia and Reading Railway Company, Reading, Pennsylvania.
- ZEEMAN, Dr. PIETER**, Stadhouderskade 158, Amsterdam, Holland.
- ZEHNDER, CHARLES H.**, Coal and Iron Merchant, Room 3018, 120 Broadway, New York City, New York.
- ZIEGLER, GEORGE W.**, Address Unknown.
- ZIESEL, EDWARD L.**, Student, 3350 North 15th Street, and for mail, 909 West Lehigh Avenue, Philadelphia, Pennsylvania.
- ZILEN, VICTOR W.**, Mechanical Engineer, 318 Auburn Avenue, Buffalo, New York.
- ZIMMERMANN, JOHN E.**, Mechanical Engineer, Member of Firm, Day and Zimmermann, 1600 Walnut Street, Philadelphia, Pennsylvania.
- ZIMMERMANN, WILLIAM**, Manufacturer of Textiles, 22nd Street and Lehigh Avenue, and for mail, 1512 West Allegheny Avenue, Philadelphia, Pennsylvania.

GEOGRAPHICAL DISTRIBUTION OF MEMBERS

ADDRESS UNKNOWN

John Byrd.
Henry S. Hale.
William B. Keefer.
John H. Kennedy.
Mrs. R. H. Krischker.
John E. Nethery.
John Richards.
O. A. Turner.
F. H. Wyeth.
George W. Ziegler.

ARIZONA

Tucson
Murphy, F. M.
Warren
Ricketts, L. D.

CALIFORNIA

Berkeley
Hersam, Earnest A.
Beverly Hills
Shattuck, A. F.
Coronado
Longstreth, Charles.
Grass Valley
Foote, Arthur DeWint.
Los Angeles
Ballard, R. H.
Harvey, Richard.
Rilliet, Charles E.
Thomas, C. O.
Severy, Melvin L.
Pasadena
Barnhart, G. Edward.
Pease, Francis G.
Stutz, Ernest.
San Diego
Stone, John Stone.
Sutton F. W.
San Francisco
McMeekin, C. W.
Quinn, C. H.
Santa Barbara
Cooper, Henry.
Stanford University
Alsberg, Carl L.

COLORADO

Colorado Springs
Hawkins, R. J. D.

CONNECTICUT

Bridgeport
Burt, M. C.
Cheshire
Bassett, W. H.
Hartford
Rice, Charles D.
Veeder, Curtis H.

New Haven

Barth, Carl G.
Johnston, John.
Sargent, Henry B.
Symons, J. E.

Rowayton

Reed, G. Berkeley.

Stamford

Getman, Frederick H.

Waterbury

Thompson, Hugh L.

DELAWARE

Bellevue

Sellers, Richard.
Sellers, Mrs. William.

Edgemoor

Chambers, A. D.
Sellers, William F.

Henry Clay

Tanberg, Arthur P.

Newport

Berg, Holger, V.
Krebs, A. S.

Wilmington

Ashbrook, Donald, S.
Bancroft, John.
Bancroft, Joseph.
Blatz, Frederick, J.
Bolton, Elmer K.
Coppage, B. Denver.
Coppage, George L.
Connable, Frank L.
Du Pont, Pierre S.
Du Pont, Irene.
Glover, Rolfe E., Jr.
Krebs, H. J.
MacGregor, Frank S.
Maxfield, H. H.
Reese, Charles L.
Robinson, Edmund G.
Sprunce, W. C.
Tatnall, Robert R.
Van Trump, S. N.

DISTRICT OF COLUMBIA

Washington

Allen, James.
Austin, Louis W.
Berliner, Emile.
Capps, W. L.
Coyle George L.
Cushman, Allerton S.
Day, Arthur L.
Day, David T.
Delano, Frederick A.
Ettinger, R. L.
Gardner, Henry A.
Humphreys, W. J.
Jenkins, O. Francis.
Jodidi, Samuel L.
Knapp, I. N.
Lewis, George W.
Lloyd, Morton G.
Moore, David Pelton.

Nutting, P. G.
 Pershing, John J.
 Rothermel, John J.
 Spencer, H. B.
 Squier, George Owen.
 Stanford, H. R.
 Stokley, James.
 Taylor, D. W.
 Wiley, H. W.

FLORIDA

Daytona
 Drake, Lewis Marvin.
 Jacksonville
 Fleming, Francis P.
 Gibbs, E. L.
 Miami
 Sulzner, C. F.
 Punta Gorda
 Price, Max Charles.

GEORGIA

Atlanta
 Adsit, Charles G.
 Bennett, C. E.
 Decatur
 Howson, Emily E.
 Savannah
 Crisfield, J. A. P.

ILLINOIS

Chicago
 Bates, Onward.
 Becker, Irwin A.
 Billow, C. O.
 Clark, Edward B.
 Converse, W. A.
 Duncan, J. S.
 Egloff, Gustav.
 Elmendorf, Armin.
 Felton, Samuel M.
 Ferguson, Louis A.
 Gibbs, Webb L.
 Gilchrist, John F.
 Gudeman, Edward.
 Hoskins, William.
 Insull, Samuel.
 Jones, W. Clyde.
 Lyman, James.
 McCormack, H.
 Michelson, A. A.
 Neiler, Samuel G.
 Otis, Spencer.
 Pearson, Frederick, J.
 Purcell, John.
 Ritter, Louis E.
 Rumely, W. N.
 Spitzglass, J. M.
 Ulmer, Carl D.
 Van Deventer, Christopher.
 Widdicombe, R. A.
 White, A. Raymond.
 Yeomans, Lucien I.

Decatur
 Chamberlain, G. E.

Eason
 Stuart, John.

Elgin
 Sargent, C. E.

Evanston
 Carter, Edward C.

Oak Park
 Oberle, Alfred.
 Parriah, T. R.

Riverside
 Silcox, L. K.
 Urbana
 Parr, S. W.
 Wheaton
 Finley, W. H.

INDIANA

Connersville
 Wilkin, John T.
 Indianapolis
 Davis, C. E.
 Ferguson, John.
 Spencer, Thomas.
 Lafayette
 Duncan, Thomas.
 La Porte
 Ballentine, William I.

IOWA

Iowa City
 Bartow, Edward.

KANSAS

Newton
 Gross, A. S.

KENTUCKY

Trappist
 Biddle, James C., Jr.

MAINE

Rumford
 Mixer, Charles A.

MARYLAND

Baltimore
 Ames, Joseph S.
 Atlee, Walter.
 Blackburn, Arthur.
 Claghorn, Clarence R.
 Emerson, G. H.
 Graham, W. F.
 Laird, Clinton N.
 Wagner, Fred. H.
 Wagner, Herbert A.
 Wilson, John S.
 Wood, F. W.
 Berwyn
 Budd, Van Wyck.
 Brunswick
 Sands, Benjamin W.
 Centreville
 Tilghman, B. C.
 Cumberland
 McKaig, W. Wallace.
 Dunkirk
 Dashiell, Benjamin J.
 Elkton
 Thomson, F. Du Pont.
 Riderwood
 Homer, F. T.

MASSACHUSETTS

Bass River
 Davis, Charles Henry.

Boston
 Anderson Robert J.
 Bannister, J. C.
 Cabot, George E.

Boston—Continued

Clark, Frank Shaw.
 Edgar, C. L.
 Lawler, G. S.
 Moyer, J. A.
 Peterson, Walter.
 Robb, Russell.
 Talbot, H. P.

Cambridge

Chaffee, E. Leon.
 Comey, A. M.
 Hoadley, Anthony DeH.
 Kennelly, A. E.
 Little, Arthur D.
 Richards, Theodore W.
 Umstead, C. H.

Chestnut Hill

Dollenbaugh, Fred S.

East Templeton

Greenwood, T. T.

Fall River

Johansen, Ernest

Lynn

Coates, Jesse.
 Mizlisch, Israel.

Pittsfield

Peck, F. W., Jr.

Swampscott

Thomson, Elihu.

Wakefield

Skinner, H. J.

Worcester

Saunders, Lewis E.

MICHIGAN

Ann Arbor

Cookey, M. E.
 Bigelow, S. L.
 Gomberg, Moses.

Birmingham

Keller, E. E.

Detroit

Lawrence, Russell E.
 Morrissey, John P.

Iron River

Byers, Isaac W.

Midland

Dow, Herbert H.

Saginaw

Fisher, E. C.

MINNESOTA

Minneapolis

Hicks, Thomas W.

MISSISSIPPI

Ocean Springs

Guthrie, Bayard

MISSOURI

Kansas City

McClelland, George W.
 Weeks, Edwin R.

St. Louis

Caspari, Charles E.
 Dempsey, W. L.
 Fitz, E. M.
 Garels, W. L.
 Kinealy, J. H.
 Mallinckrodt, E.
 Pond, E.

NEW HAMPSHIRE

Chesham

Lightfoot, Thomas M.

Danbury

Murdock, Joseph B.

NEW JERSEY

Atlantic City

Burk, Charles A. D.

Bloomfield

Shackelford, B. E.

Bloomington

Donald, William.

Bridgeton

Smith, Oberlin.

Caldwell

Potter, Rowland S.

Camden

Casselman, William S.
 Fitta, J. Logan.
 Haigis, C. D.
 Kerlin, W. D.
 McGowen, J., Jr.
 Ringwalt, Rowland.
 Sauer, Frank H.
 Townend, Robert V.

Dover

Canfield, Frederick A.

Englewood

Gubelman, F. J.

Elizabeth

Pope, Ralph W.

Glen Ridge

Kilpatrick, J. L.

Gloucester

Knoedler, E. L.
 Mason, Sidney.
 Miner, Harlan S.
 Ritchie, Kenneth M.

Haddonfield

Braddock-Rogers, K.

Haddon Heights

Fernandez, G. D.

Hammononton

Cottrell, James W.

Harrison

Allan, Andrew, Jr.
 Howell, J. W.

Hoboken

Burhorn, Edwin.
 Humphreys, A. C.
 Smith, E. A.

Jersey City

Holmes, George R.
 Ittner, Martin Hill.

Laurel Springs

Andreau, Roland L.

Maplewood

Wilson, William.

Merchantville

Patterson, Edward B.

Millville

Furness, George W.
 Lewis, Daniel C.

Montclair

Ellis, Carleton.
 Gesell, William H.
 Loeb, Leo.
 Steuber, Henry J.

Moorestown

Middleton, Albert C.

New Brunswick

Clark, A. Wayne.
Waldron, William H.

Newport

Ellis, Malcolm.
Farrand, Dudley.
Pinkbiner, E. W.
Heitman, Edward.
Kuttruff, Edwin.
Merz, Eugene.
Weston, Edward.

Orange

Buchanan, C. C.
Colvin, Fred. H.
Edison, Thomas A.
Pitman, John.
Wells, G. A.

Paulsboro

Oakleaf, J. F.

Perth Amboy

Roesler, Franz.

Phillipsburg

Caton, John J.

Plainfield

Condict, G. H.

Princeton

Greene, Arthur M.
Lewis, Paul A.
Northrup, E. F.
Trowbridge, Augustus.

Rahway

Forrest, Charles N.
Kippenburg, Henry.
Murray, B. L.

Riverton

Atlee, Joshua W.
Flanagan, Charles L.
Flanagan, Louis A.
Murray, H. H.

Rewaren

Cowles, Alfred H.

Short Hills

Badenhausen, Carl W.

Somerville

Livingston, Herman.

Summit

Gilpin, Francis H.

Vineland

Greene, Joseph F.

Wildwood Crest

King, Charles W. G.

NEW YORK**Bronxville**

Kebler, Leonard.
Waller, Alfred E.

Brooklyn

Colvin, Charles H.
Colvin, Fred H., 2nd.
Cowan, Wm. A.
Halsey, Wm. B.
Hooker, Samuel O.
Miller, R. H.
Rowland, Charles B.
Schlicke, C. P.
Sperry, Elmer, A.
Slater, Howard C.
Wells, W. F.

Buffalo

Bierbaum, C. H.
Calkins, G. H.
Gfrorer, A. H.
Grissinger, Elwood.
Zilen, Victor W.

Corning

Gage, Henry Phelps.

Flushing

Adams, Merritt H.
Oatley, H. B.

Ithaca

Barr, John.

Long Island City

D'Utassy, George.

New York City

Acheson, E. G.
Addicks, Walter R.
Akeley, Carl E.
Arnold, H. D.
Army, H. V.
Bacon, Raymond F.
Baker, Franklin, Jr.
Basford, G. M.
Bell, J. Snowden.
Bourne, George L.
Bradley, A. L.
Briesen, Frits V.
Buck, H. W.
Bullock, William E.
Bunnell, Sterling H.
Carty, John J.
Chandler, Charles F.
Coffin, C. A.
Darrow, K. K.
Dickerson, Edward N.
Doherty, Henry L.
Dorr, John V. N.
Dougherty, C. J.
Douthirt, Walstein F.
Dubilier, William.
DuBosque, F. L.
Dunn, Gano.
Dyer, F. L.
Eldred, Byron E.
Emerson, Harrington.
Engelhard, Charles.
Erhart, W. H.
Falkenau, Arthur.
Fairchild, Sherman M.
Finch, Harold H.
Fries, Harold H.
Fuller, George W.
Gherardi, Bancroft.
Gibson, John J.
Granbery, J. H.
Griswold, Robert G.
Hallberg, J. H.
Hammer, Edwin W.
Hammer, William J.
Haschka, Ferd. T.
Hazen, Allen.
Hendrick, Elwood.
Herr, Edwin M.
Herty, Charles H.
Hinrich, Hans.
Hirschland, F. H.
Hitchins, Alfred B.
Honaman, R. K.
Howard, A. C.
Ives, Herbert E.
Jackson, John Price.
Jacobus, D. S.
Junkersfeld, Peter.
Kaufmann, H. M.
Kennedy, J. J.
Kingsbury, E. F.
Klipstein, A.
Knox, Henry Hobart.
Kruttschnitt, J.
Kunz, George F.
Lewis, Nathan E.
Lieb, J. W.
Lieber, Hugo.

New York City—Continued

Lindenthal, Gustav.
 Lucas, Francis F.
 Lucke, Charles E.
 MacBeth, Norman.
 McKechan, L.
 Macalpine, J. Kenneth W.
 Mackenzie, K. G.
 Mailloux, C. O.
 Mayer, Nelson B.
 Merriman, Thaddeus.
 Mershon, Ralph D.
 Metz, Herman A.
 Milner, B. B.
 Moran, Daniel E.
 Murray, Thomas E.
 Murray, William S.
 Nicholas, William H.
 Orrok, George A.
 Osbourne, L. A.
 Parish, LeGrand.
 Perry, Robert S.
 Pope, Frederick.
 Postlethwaite, C. E.
 Ramsey, George W.
 Ranger, Richard H.
 Rautenstrauch, Walter.
 Reber, Samuel.
 Reno, Jesse W.
 Reoch, Alexander E.
 Richardson, Charles E.
 Ridgway, Robert.
 Roller, Frank W.
 Rooney, Frederick M.
 Rosenbaum, W. A.
 Schlafge, William.
 Sharp, Clayton H.
 Smith, A. T.
 Smith, Frank W.
 Smith, J. Waldo.
 Snare, F.
 Snook, H. Clyde.
 Southall James P. C.
 Spicer, H. N.
 Sprague, Frank J.
 Sprong, S. D.
 Stillwell, Lewis B.
 Teeple, John E.
 Tikhonovitch, Benedict.
 Toch, Maximilian.
 Torchio, Philip.
 Underwood, Frederick D.
 Van Deventer, H. R.
 Vreeland, Frederick K.
 Waddell, J. A. L.
 Wadleigh, F. R.
 Wallerstein, Leo.
 Webster, Albert L.
 Weiss, J. M.
 Williams, A. L. W. *
 Woodhouse, Henry.
 Wright, Roy V.
 York, H. W.
 Yorke, George M.
 Zehnder, Charles H.

Niagara Falls

Berresford, A. W.
 Fitzgerald, Francis A. J.

Port Washington

MacLean George.

Rochester

Poser, M.
 Saegmuller, G. N.

Rye

Robinson, Dwight.
 St. John, Ancel.

Scarsdale

Atwater, R. M., Jr.

Schenectady

Andrews, W. S.
 Berg, Ernest J.
 Berg, P. Eskil.
 Capp, John A.
 Kellers, Charles.
 Keith, C. P.
 Lichtenberg, Chester
 Lovejoy, J. R.
 Ortenblad, R.
 Rice, E. W.
 Stevenson, Alexander R.
 Stone, C. W.
 Trench, W. W.
 Vaughen, F. G.
 Vogdes, Francis B.

Syracuse

Fryer, George G.

Tarrytown

Whyte, F. M.

Troy

Caird, James M.
 Diven, J. M.
 Mason, W. P.

Voorheesville

Horton, Robert S.

Warwick

Hitchcock, Fanny R.

Yonkers-on-Hudson

Baekeland, L. H.

NORTH CAROLINA

Ardan

Rumbough, John B.

OHIO

Akron

Jones, Philip C.

Cincinnati

Freeman, W. W.
 Hill, John W.
 Lloyd, John Uri.
 Muller, E. A.
 Viall, Ethan.

Cleveland

Abbott, Robert R.
 Ashmead, Frank M.
 Cox, J. D.
 Doane, Samuel E.
 Jefferies, Zay.
 Karrer, Enoch.
 Lihme, I. P.
 Luckiesh, M.
 MacBain, D. R.
 Smith, Albert W.

Columbus

Bush, S. P.
 Smith, Iowa.
 Stout, Orin C.

Dayton

Craig, Robert.
 Ohmer, Will I.
 Tait, Frank M.
 Toulmin, H. A.
 Wright, Orville.

Middletown

Eppelshimer, Daniel.

OKLAHOMA

Ponca City

Eckhardt, E. A.

OREGON

Travis Pass
Canby, William W.
Portland
Bilyeu, Thomas.

PENNSYLVANIA

Abington
Merritt, James Smith.
Allentown
Trexler, Harry C.
Snelling, Walter O.

Altoona
Pease, F. N.
Smith, P. F.

Ambler
Hagar, Walter F.
Smith, Irving B.

Ardmore
Daily, Francis X.
Erne, Alfred.
Kent, A. Atwater.
Lovekin, Luther D.
Sellers, Horace W.
Snyder, Monroe B.
Worrell, Howard S.

Bellevue
Lower, Nathan M.

Bethayres
Lippincott, Joseph W.

Bethlehem
Ford, Terrance.
Kinnier, G. E.
Rau, Albert George.
Wilbur, W. A.

Bryn Athyn
Boericke, Felix A.
Howard, Wilfred.
Synnestvedt, Arthur.

Bryn Mawr
Barnes, James.
Crenshaw, James L.
Ferree, Clarence Errol.
Horn, David W.
Smith, W. Hinckle.
Townsend, J. W.
Vaux, George, Jr.
Wood, Allen, 3rd.

Bristol
Hollander, Charles S.

Brookline
Holst, L. J. R.

Butler
Christianson, A.

Burnham
Skinner, O. C.

Chester
Hart, Charles.
Palmer, T. Chalkley.
Palmer, Walter.
Shattuck, John D.
Stevenson, S. Price.
Wetherill, Robert.
Woodbury, C. A.

Chester Heights
Moore, Horace E.

Coatesville
Ridgway, Ellis B.
Ridgway, William H.

Collegeville
Clamer, F. J.
Tyson, H. P.

Conshohocken
Wood, Biddle.

Cynwyd
Comer, Harris.
Haupt, Lewis M.

Darby
McConnell, Jacob Y.

Darlington
Willcox, W. F.

Devon
Bright, John Irwin.
Doan, Thomas J.
Walker, J. W.
Welsh, Francis Ralston.

Easton
Cornelius, Justice C.
Hart, Edward.
Raymond, Ward.
Shimer, Porter W.
Wilson, J. Hunt.

Egypt Mills
Spackman, H. S.

Elwood City
Brownstein, Benjamin.

Erdenheim
Wood, Robert L.

Erie
Durban, Thomas E.

Franklin
Rhoades, Joseph J.

Gettysburg
Parsons, Louis A.

Glenolden
Nichols, Leon W.

Greenburg
Donohoe, John P.

Harrisburg
Irons, Robert H.
Masters, Frank M.

Haverford
Curwen, Samuel M.
Felton, E. C.
Klemm, J. G., Jr.
Lewis, Wilfred.
Measey, William Paul.
Morris, A. Saunders.
Palmer, Frederick.
Robinson, Anthony W.
Sagebeer, Richard G.
Sawtelle, William Otis.
Woolman, Edward.

Hazleton
Markle, A.

Highland Park
Birch, George W.

Irwin
Miles, J. Walter.

Jeddo
Markle, John.

Jenkintown
Benzon, George H., Jr.
Gibson, Henry Clay.

Johnstown
Crichton, Andrew B.

Kennett Square
Phillips, Edwin S.

Lancaster
Widmyer, J. H.

Lansdowne
Deshong, Howard T.
Huttinger, W. R.
Pennock, George L.
Roberts, Charles O.
Wilson, Alexander, 3rd.

- Marcus Hook**
Griffin, Frank H.
Smith, W. Leigh.
- Mauch Chunk**
Kemmerer M. S.
- Mechanicsburg**
Strong, William Walker.
- Media**
Trautwire, John C., 3rd.
Wilson, J. L.
- Melrose Park**
Hyatt, Clinton Brown.
- Merion**
Boericke John J.
Davis, R. W.
- Millbourne**
Sellers, Howard.
- Millersville**
Davidheiser, Lee.
- Minersville**
Snyder, Clinton F.
- Narberth**
Bates, C. W.
Shand, A. C.
- Natrona**
Huff, Ernest, L.
- New Castle**
Kirk, C. J.
- New Hope**
Miller, Fred. J.
- Newtown**
Atkinson, Robert.
- Parksburg**
Beale, Horace A., Jr.
Woodroffe, G. H.
- Phoenixville**
Rapp, I. M.
Wetherill, H. E.
- Philadelphia**
Abrams, Peter.
Aertsen, Guillaem.
Akerlow, G. W.
Akimoff, Nicholas W.
Albrecht, A. O.
Albrecht, Herman C.
Allen, Arthur H., Jr.
Allen, Henry B.
Allen, William N.
Anderson, Cyrus N.
Armstrong, William R.
Asef, W.
Ashhurst, John.
Atterbury, W. W.
Austin, W. L.
Ayers, Eugene E.
Bache, Daniel.
Baker, George F.
Balch, Alfred C.
Balch, E. S.
Balls, William H.
Baldwin, Frederic E.
Banta, Clifford.
Barnes, John H.
Barnett, Edwin S.
Barringer, D. W.
Beale, Leonard T.
Beath, E. R.
Belfield, T. B.
Bement, W. F.
Bennett, F. M.
Biddle, Charles M.
Biddle, Elizabeth C.
Biddle, Robert.
Bilgram, Hugo.
- Binder, Richard L.
Birkinbine, Carl P.
Blackburn, Caroline D.
Blair, A. A.
Blum, Arthur N.
Bodine, S. T.
Boekel, J.
Bonine, Charles E.
Booz, H. C.
Borie, Beauveau.
Borton, George W.
Bowen, Samuel B.
Bower, William Henry.
Boyer, Murray C.
Bradbury, Robert H.
Brady, Edward J.
Breed, George.
Brewer, Robert W. A.
Brinley, Charles E.
Brinton, Clement Starr.
Brinton, R. L.
Brock, John W.
Bromley, Joseph H.
Brown, Francis Shunk.
Brown, Richard P.
Brown, T. Wistar.
Bruner, Frank A.
Brunker, Robert J.
Budd, Edward G.
Bureau, E. W.
Burgess, William J.
Burroughs, Joseph H.
Busser, Frank S.
Calvert, Harold.
Capp, S. Bunker.
Catherwood, Wilson.
Chambers, Francis T.
Chambers, J. Howard.
Chance, E. M.
Chance, H. M.
Chandler, T. P.
Charlton, Richard C.
Chesterman, Francis T.
Church, Arthur L.
Clamer G. H.
Clark, A. Wayne.
Clark, Beauvais.
Clark, Darthela.
Clark, E. W.
Clark, Joseph S.
Clark, Edward L.
Clark, Theobald F.
Clark, Walton.
Clark, Mrs. Walton.
Clark, Walton, Jr.
Clymer, E. M.
Collins, Henry H.
Collingswood, J. Reed.
Collom, Samuel H.
Conaway, John F.
Conn, Charles F.
Cooke, Morris L.
Cope, Thomas D.
Cornelius, Clarence.
Cornelius, J. C.
Cox, John L.
Cox, Walter.
Coxe, Alexander B.
Cramp, Francis L.
Crampton, George S.
Croasdale, John P.
Crook, Alfred.
Crowell, Walter S.
Cullen, George S.
Cummings, J. H.
Curtis, Cyrus H. K.
Curtiss, Elliott.
Da Costa, John C., 3rd.
Dannenbaum, Herman.

Philadelphia—Continued

- Dashiell, P. T.
 Dawes, James H.
 Dawson, Wilfred Thomas.
 Day, Charles.
 Dillenbeck, Clark.
 D'Invilliers, E. V.
 Disston, William D.
 Dobson, William A.
 Dodge, Kern.
 Dorner, William F.
 Dourcoudre, Bernard L.
 Doyle, William J.
 Drexel, John R.
 Dundore, Charles R.
 Earnshaw, Warner G.
 Eberle, E. G.
 Eckert, S. B.
 Eglin, W. C. L.
 Ehrenfeld, Frederick.
 Ehret, C. D.
 Elcock, John J.
 Elkins, George W.
 Elkinton, Howard W.
 Elkinton, Thomas W.
 Elliott, Edwin.
 Ellis, William G.
 Elverson, James, Jr.
 Emerick, J. M.
 Erne, Alfred.
 Evans, O. B.
 Evans, Powell.
 Evans, Wayne S.
 Eyanson, J. Edward.
 Fairchild, S. E., Jr.
 Faught, L. Ashlev.
 Fearing, Frederick C.
 Fearon, Charles.
 Fels, Maurice.
 Fels, Samuel.
 Fernald, R. H.
 Fisher, Thomas.
 Fitzmaurice, William J., Jr.
 Fleisher, B. W.
 Fletcher, W. E.
 Ford, Bruce.
 Forstall, Walton.
 Francis, Isaac H.
 Franklin, Benjamin.
 Frazier, George H.
 Frazier, W. W.
 French, Howard B.
 Fry, Ann W.
 Fuguet, H.
 Fulweiler, W. H.
 Funk, N. E.
 Furness, H. H.
 Furness, Radclyffe.
 Galloway, C. D.
 Garrigues, F. H.
 Garrison, F. Lynwood.
 Gartley, William H.
 Gazzam, J. M.
 Gerhard, Arthur Howell.
 Gest, William P.
 Gibbs, A. E.
 Giles, Irwin K.
 Gill, John D.
 Gittleson, Frank.
 Glendinning, Robert E.
 Goetzenberger, Ralph L.
 Goheen, J. P.
 Goldbaum, Jacob S.
 Goldsmith, E.
 Goldsmith, Edwin M.
 Goodspeed, Arthur W.
 Goodwin, Harold, Jr.
 Grafton, E. H.
 Gravel, J. H.
 Green, George R.
 Greenwood, Richard.
 Grevenmeyer, G. A.
 Gribbel, John.
 Gribbel, W. Griffin.
 Griffith, W. O.
 Griest, Thomas H.
 Gucker, F. T.
 Haines, Caspar Wistar.
 Haines, Robert B., Jr.
 Haines, William A.
 Hall, O. A.
 Hall, George R.
 Hanthorn, Joseph R.
 Harrison, A. C.
 Harrison, C. O.
 Harrison, G. L.
 Harrison, J. K. M.
 Harrison, Thomas R.
 Harrison, W. W.
 Hartung, Adolph.
 Hartzel, Francis W.
 Heyward, Nathan.
 Helme, William E.
 Renzon, Edward Francis.
 Hepburn, Joseph S.
 Hering, Carl.
 Hering, Walter E.
 Hiergesell, Valentine.
 Higgins, R. S.
 Hires, Charles E.
 Hofstetter, George.
 Holland, Walter E.
 Hopping, Ernest L.
 Horn, Franklin S.
 Houston, John J. L.
 Houston, Samuel F.
 Howe, Arthur W.
 Howson, Charles Henry.
 Howson, Henry.
 Howson, Richard.
 Huhn, G. A.
 Hutchinson, S. Pemberton.
 Indahl, Mauritz O.
 Ingersoll, Charles E.
 Irish, W. M.
 Israel, Joseph D.
 Ives, Fred S.
 Jackson, A. C.
 Jackson, William Steel.
 James, William Fry.
 Jeanes, Isaac W.
 Jenkins, Theodore F.
 Jennings, W. N.
 Johnson, C. N.
 Johnson, Ernest.
 Johnson, J. C.
 Johnson, W. H.
 Johnson, William A.
 Jones, Jonathan R.
 Jones, Julian D.
 Justi, Henry M.
 Kabakjian, D. H.
 Kaltenthaler, H. J.
 Kavanaugh, William H.
 Kelly, George L.
 Kellog, Hosford D.
 Kennedy, Frank G.
 Kennedy, M. C.
 Kent, S. Leonard, Jr.
 Kerr, William M.
 Ketcham, O. W.
 Ketterlinus, J. L.
 Kimber, W. M. C.
 King, Joseph, B., Jr.
 Kinnard, L. H.
 Kirsoff, E. C. B.
 Kline, C. M.
 Klumpp, John Bartleman.

Philadelphia—Continued

Knapp, Arthur.
 Kohn, Joseph.
 Kneass, Strickland L.
 Kuesel, George C.
 Kuhn, C. Hartman.
 Landreth, C. P.
 Lanza, G.
 Lathrop, Elbert C.
 Lauer, Conrad.
 Lavino, E. J.
 LaWall, Charles H.
 Lay, John Tracy.
 Ledoux, J. W.
 Lee, Elisha.
 Lee, James D.
 Lee, Walter T.
 Leeds, Morris E.
 Leffmann, Henry.
 Leighninger, William B.
 LeMaistre, F. J.
 Lemoine, L. R.
 Lesley, Robert W.
 Levy, Howard S.
 Levy, Lionel F.
 Levy, Max.
 Lewis, A. Nelson.
 Lewis, Howard W.
 Lewis, John F.
 Lewis, Robert B.
 Lippincott, J. Bertram.
 Lillie, Lewis.
 Lillie, S. M.
 Liversidge, Horace P.
 Llewellyn, W. H.
 Lloyd, Herbert.
 Lodge, Rolla M.
 Lonergan, J. E.
 Longstreth, E. T.
 Lowe, Arthur W.
 Lo-d, Sarah A. C.
 Lukens, Hiram S.
 Lupton, Edward.
 Lynch, J. C.
 Lyon, Percy S.
 Ly-le, Frederic Bowers.
 McArthur, George P.
 McBride, Thomas C.
 McCall, Joseph B.
 McCall, Richard C.
 McConnell, Franklin P.
 McDowell, Charles.
 McFadden, George H.
 McGeorge, Percy.
 McIlhenny, John D.
 McLean, William L.
 McVey, John Joseph
 Madeira, Percy O.
 Manwaring, A. H.
 Marshall, Thomas H.
 Martin, Thomas S., 3rd.
 Martocello, Joseph A.
 Masland, Charles H., 2nd.
 Meeker, G. H.
 Melcher, William C., Jr.
 Mellor, Norman.
 Melody, Michael.
 Merrick, J. Hartley.
 Merick, J. V.
 Metten, John F.
 Miller, Simon.
 Milne, David.
 Milne, Francis F., Jr.
 Mills, George M.
 Missimer, George, Jr.,
 Mitchell, Henry F.
 Mitchell, Walter M.
 Mitcheson, Joseph MacGregor.
 Mitten, T. E.

Modjeski, Ralph.
 Moody, Lewis F.
 Morgan, Marshall S.
 Morgan, Randal
 Morris, Eflingham B.
 Mull, J. H.
 Murray, J. F.
 Newbold, Clement B.
 Nice, Eugene E.
 Nicholas, Carroll B.
 Nightingale, Donald A.
 North, R. H.
 Noyes, Stephen H.
 Oerlein, Karl F.
 Olsen, Thorsten Y.
 Olsen, Tinius.
 Ott, G. F.
 Outerbridge, A. E.
 Owen, Bartram Ashmead.
 Parker, Edward W.
 Parker, John C.
 Patterson, Francis D.
 Patterson, J. Edward.
 Paul, H. N.
 Paul, Lawrence T.
 Peacock, Selina Emma.
 Pearson, Joshua.
 Peck, G. L.
 Pemberton, Ralph.
 Pender, Harold.
 Penrose, Charles.
 Penrose, R. A. F., Jr.
 Pepper, David.
 Perot, T. Morris.
 Perrot, Emile G.
 Pew, J. Howard.
 Pierce, G. A.
 Plack, W. L.
 Platt, H. H.
 Porter, Horace C.
 Porter, J. B.
 Porter, Roland G.
 Potts, Joshua R. H.
 Price, M. M.
 Quimby, Henry H.
 Raff, A. Raymond.
 Rea, Samuel.
 Reath, Theodore W.
 Rebmman, Howard, G. R.
 Reeder, Howard E.
 Reichardt, H.
 Reilly, Marion.
 Resines, Javier.
 Richards, Horace C.
 Riehle, Fred A.
 Rigling, Alfred.
 Riley, Lewis A.
 Robinson, W. W.
 Rodman, Jessie A.
 Rogers, Frank H.
 Rogers, James S.
 Rolle, Sylvan D.
 Rondinella, L. F.
 Roosevelt, Nicholas G.
 Rosen, Joseph.
 Rosenbaum, Morris.
 Rosengarten, Frederic.
 Rosengarten, George D.
 Rose, T. Edward.
 Rowland, Theodore S.
 Rusby, J. M.
 Russell, Charles J.
 Rust, Henry P.
 Sadtler, Samuel S.
 Safford, Frederick H.
 Salmon, Pedro G.
 Samuel, J. Bunford.
 Sanborn, Edward H.
 Sanford, Rufus H.

Philadelphia—Continued

Sanville, Henry F.
 Sartain, Paul J.
 Satterthwaite, George.
 Saunders, William E.
 Scannell, Gerald E.
Schehl, Oscar L.
 Schrom, Oscar G.
 Seely, Leslie B.
Sellers, Alexander.
Sellers, Coleman, 3rd.
Senter, Ralph Townsend.
 Shoemaker, Samuel.
 Shoemaker, Thomas H.
 Schmidheiser, W. A.
 Shober, Samuel L.
 Shrader, J. E.
 Simsohn, Julian A.
 Sinkler, John P. B.
 Smalling, Elmer, Jr.
 Smith, A. D. W.
Smith, Edward W.
Smith, Haseltine.
Smith, N. W.
 Smith, S. D.
 Smith, Walter B.
 Spencer, Paul.
 Spitz, Samuel.
 Sproul, William C.
 St. Clair, William.
 Steel, Joseph M.
 Steiner, Oscar.
 Steinmetz, J. A.
 Stevens, John S.
 Stewart, Frank H.
Stewart, Frank H.
 Stewart, Ralph C.
 Stewart, Thomas S.
 Stine, Wilbur M.
 Stoertz, Howard.
 Stokes, Francis J.
 Stotesbury, E. T.
 Stoughton, A. B.
 Stradling, G. F.
 Stroud, E. A.
 Styri, Haakon.
 Supplee, W. H.
 Sykes, John P.
 Taggart, Walter T.
 Taylor, H. Birchard.
 Taylor, Hollingshead N.
 Thamm, Charles G. A.
 Thomas, Arthur H.
 Thompson, Paul.
 Thorne, William H.
 Thwing, Charles Burton.
 Tily, H. J.
 True, Rodney H.
 Trueman, William H.
 Tuttle, E. B.
 Tuttle, William C.
 Tyler, Sydney F.
 Vail, James G.
 Van Dyke, J. W.
 Vauclain, S. M.
 Vogdes, Joseph J.
 Vogelson, John A.
 Vollrath, Alfred J.
 Wagner, John.
 Wagner, Samuel T.
 Wagner, Tobias.
 Wagner, Walter C.
 Wallis, J. T.
 Walton, Horace.
 Warden, William G.
 Warner, William R., Jr.
 Warnock, James.
 Warriner, S. D.
 Wateon, James.

Weatherwax, James Lloyd.

Webster, George S.
 Webster, William R.
 Weinberg, S.
 Welles, Howard W.
 Welz, Earl H.
 Wetherill, S. P.
 Wetherill, William C.
 Weyl, Charles N.
 Wharton, Henry.
 Whitaker, James L.
 White, J. Atwood.
Whitney, Charles H.
Whitney, E. B.
Whitney, F. E.
Wiegand, John.
 Willie, H. V.
 Williams, E. D.
 Williams, Ira Jewell.
 Williams, William J.
 Wilson, Arthur M.
 Wilson, H. A.
 Wilson, H. D.
 Wilson, Henry W.
 Wilson, James E.
 Wolf, D. D.
 Wolf, John Jacob.
 Wood, Albert C.
 Wood, E. R., Jr.
 Wood, Walter.
 Woodbridge, J. Lester.
 Woodward, George.
 Wright, Frank L.
 Wyatt, James H.
 Yarnall, D. Robert.
 Ziesel, Edward L.
 Zimmermann, John E.
 Zimmermann, William.

Pittsburgh

Crawford, D. F.
 Cunningham, J. L.
 Denig, Fred.
 Didier, Paul.
 Eavenson, Howard N.
 Garman, F. R.
 Hower, Harry S.
 Jones, Jonathan.
 Koch, J. A.
 Marbaker, Edward.
 Milliken, J.
 Moore, W. E.
 Ramsburg, C. J.
 Rittman, W. F.
 Rugg, W. S.
 Sieg, Lee Paul.
 Skinner, C. E.
 Sperr, F. W.
 Taber, George H.
 Tiemann, Hugh P.
 Thompson, Arthur W.
 Wadsworth, F. L. O.
 Weidlein, Edward R.
 Whitney, Louis B.

Pottstown

Buxton, George Edward.
 Fretz, E. S.

Radnor

Scott, William M.
 Titzel, R. John.

Reading

Heilman, D. B.
 Tait, Edward H.
 Thomas, L. E.
 Young, J. Bertram.

Ridley Park

Angerer, Victor.
 Manning, E. R.
 Woodie, Allan S., Jr.

St. Davids
Bostwick, J. V.
Freeman, Harold A.

Scottdale
Oberly, Albert D.

Sharon Hill
Maitland, Harold T.

State College
Wendt, Dr. Harold L.

Stratford
Kothny, G. L.

Stroudsburg
Smith, H. S. S.

Sunbury
Lenker, Will G.

Swarthmore
Alleman, Gellert.
Creighton, H. Jermain.
Hoadley, George A.
Munroe, Charles W.
Myers, Allen.
Sellers, Richard C.
Temple, Edward B.
Wright, Winthrop R.

Suedeland
Tiddy, William.

Tamaqua
Hill, Roy Linden.
Pratt, Carl D.

Verona
Rodman, Hugh.

Wallingford
Biddle, James G.
Miller, Casper W.

Wawa
Wilcox, James M.

Wayne
La Boutillier, Henry W.
Le Boutillier, Robert.
Redfield, Robert S.

West Chester
Christman, O. S.
Cochran, C. B.
Hetzel, Frederic V.
Taylor, Lowndes.

West Conshohocken
Tutwiler, O. C.

Williamsport
Davis, Ernest H.

Wyndmoor
Bower, C. P.

Wynnewood
Boericke, Gideon.
Hall, R. T.
Weston, F. W.

Wyebooke
Potts, William M.

RHODE ISLAND

Bristol
Herreshoff, Nathanael G.

Newport
Norman, Bradford.
Norman, Reginald.
Sims, William S.

Providence
Burlingame, L. D.
Saunders, Walter M.

SOUTH CAROLINA

Sumter
Mason, Charles Thomas.

TENNESSEE

Bristol
Whitney, Asa.

Nashville
MacDonald, Hunter.

TEXAS

College Station
Neblette, Carrol B.

Houston
Detwiler, J. G.

UTAH

Salt Lake City
Anderson, Frank.
Cameron, F. K.

VERMONT

Bennington
Beach, Charles S.

Springfield
Fellows, E. R.
Flanders, Ralph E.
Hartness, James.

VIRGINIA

Charlottesville
Dunnington, F. P.

Nokesville
Harrison, Mitchell.

Norfolk
Caples, M. J.

Richmond
Salmon, Frederick.

WASHINGTON

Seattle
Collins, C. R.

Rosario
Moran, Robert.

WEST VIRGINIA

Wheeling
Pcacock, S.

WISCONSIN

Appleton
Power, Archie Dayton.

Beloit
Suydam, V. A.

Madison
Lenher, Victor.
Mathews, J. H.
Swenson, Magnus.

Milwaukee
Beck, M. A.
Frank, Edwin.
Hatton, T. Chalkley.
Uehling, E. A.
White, W. M.

BRAZIL

Rio de Janeiro
Billings, A. W. K.

CANADA

Lachine
Berliner, Herbert S.

Montreal
Eve, A. S.
Job, Robert.
Shaw, A. Norman.
Vaughan, H. H.

Quebec
Wright, James A.

Toronto
Miller, W. L.

ENGLAND

Cambridge
Rutherford, Ernest.
Thomson, Joseph J.

London
Cloud, John W.
Forbes, George.
Gordon, Hugh S.
Merz, Charles H.
Sanderson, R. P. C.
Tate, Alfred O.
Unwin, William Cawthorne.

Newcastle-On-Tyne
Parsons, Charles A.

Oxford
Townsend, John Sealy.

Sheffield
Hornsey, John W.

FRANCE

Paris
Casacof, Christo.
Fabry, Charles.
Ferrie, G.

GERMANY

Berlin
Thurow, W. H.
Heidelberg
Goldschmidt, V.

HOLLAND

Amsterdam
Zeeman, Pieder.
Eindhoven
De Graaff, Antonius.
Haarlem
Lorents, Henrik A.
Leiden
Onnes, Heike Kamerlingh.

ITALY

Rome
Marconi, Guglielmo.

JAPAN

Kyoto
Sonoda, S.

NEW ZEALAND

Wellington
Cockerill, H. W.

NORWAY

Kristiania
Anderson, Olaf.
Lobben, Peder.
Loss, Henrik von Z.

PHILLIPINE ISLANDS

Manila
Selga, M.

PORTO RICA

Fajardo
Crago, W. H.

SOUTH AFRICA

Cape Town
Van der Ling, J. Stephen.

SWEDEN

Stockholm
Arrhenius, Svante A.

Important New Scientific Publications

-
- PETROLEUM.** By SIR BOVERTON REDWOOD, Bart. New Edition, Revised and Reset. In Three Volumes with Plates, Numerous Illustrations in the Text and Many New Maps Especially Prepared for this Edition. 1353 Pages. **\$39.00**
- HANDBOOK OF INDUSTRIAL OIL ENGINEERING.** By JOHN ROME Battle, B.S., M.E. 1100 Pages, Thumb Index, 350 Illustrations, 40 Curves, 100 Useful Tables, 9 Color Plates, 9 Charts, Large Octavo, Cloth. An invaluable reference book for oil engineers. **10.00**
- A SHORT HANDBOOK OF OIL ANALYSIS.** By AUGUSTUS H. GILL, S.B., Ph.D. Tenth Edition, Revised (1922). The standard short handbook for chemists and engineers. Illustrated, Diagrams, Tables, 12mo. **2.50**
- INDUSTRIAL ORGANIC CHEMISTRY.** By SAMUEL P. SADTLER, Ph.D., LL.D., and LOUIS J. MATOS, Ph.D. Fifth Edition, Revised, Enlarged, and in Part Rewritten. Adapted for the Use of Manufacturers, Chemists, and all Interested in the Utilization of Organic Materials in the Industrial Arts. **8.00**
- ORGANIC CHEMISTRY.** By W. H. PERKIN, Ph.D., and F. STANLEY KIPPING, Ph.D. New Edition (1922). Completely Revised. 681 Plus xx Pages. Illustrated. **2.50**
- AUTOMATIC PUMPING.** By W. WALKER FYFE. Numerous Illustrations, Diagrams and Tables with Notes on Water Analysis and Filtration. **3.00**
- A TEXT-BOOK OF INORGANIC CHEMISTRY.** Volume IX, Part Two. Iron. By J. NEWTON FRIEND, D.Sc., Ph.D., F.I.C. Frontispiece and 8 Illustrations. **7.50**
- COKE-OVEN AND BY-PRODUCT WORKS CHEMISTRY.** By THOMAS BIDDULPH-SMITH. 62 Illustrations and 7 Folding Plates. 196 Pages. **7.00**
- SOME MICROCHEMICAL TESTS FOR ALKALOIDS.** By CHARLES H. STEPHENSON. Illustrated with 27 Plates including 162 Photomicrographs of Tests. **4.00**
- ANIMAL AND VEGETABLE FIXED OILS, FATS, BUTTERS AND WAXES.** By C. R. ADLER WRIGHT. 3 Plates and 185 Illustrations. New Edition, Revised and Enlarged. **20.00**
- THE CLAYWORKER'S HANDBOOK.** By ALFRED B. SEARLE. New Illustrations. New Edition, Revised and Rewritten. **6.50**
- CYANIDING GOLD AND SILVER ORES.** By H. F. JULIAN and EDGAR SMART. Numerous Illustrations, Plates and Maps. New Edition, Revised. **12.50**
- OIL FUEL.** By EDWARD BUTLER. Numerous Illustrations. New Edition, Revised and Enlarged. **5.00**
- PETROLEUM REFINING.** By ANDREW CAMPBELL. Illustrated. New Edition, Revised. **8.50**
-

J. B. LIPPINCOTT COMPANY

PHILADELPHIA

LONDON

CHICAGO

MONTREAL



DAY & ZIMMERMANN

INCORPORATED

Engineers

Design Construction Valuations

Investigations and Reports

Management of Public Utilities

NEW YORK

2 Wall Street

PHILADELPHIA

1600 Walnut Street

CHICAGO

Harris Trust Bldg.

Fidelity Trust Company has been acting
under all forms of trust arrangements for
more than half a century.

FIDELITY TRUST COMPANY

Capital \$5,200,000

Surplus \$16,000,000

325 Chestnut Street 6324 Woodland Ave.

1431 Chestnut Street West Philadelphia

Funds held in Trust more than
\$345,000,000

AMERICAN PLATINUM WARE

Standard Ware—Made of our specially refined platinum.
Meets the most exacting demands of the laboratory worker.

Complete Catalogue No. 15 on request

AMERICAN PLATINUM WORKS
NEWARK, N. J.

The Viscose Company

Marcus Hook, Pa.

SWITCHES

PANEL BOARDS

SWITCHBOARDS

THE PRINGLE ELECTRICAL M'FG CO.

1906-12 North Sixth Street

PHILADELPHIA

MATERIAL built to meet your requirements. Not sold by the yard.

Engrossing

Illuminating

Designing

Resolutions, Testimonials, Memorials,
Charters and Penwork of Every
Description :: :: :: :: :: :: :: ::

Commercial Work for Every Purpose

PENCIL LAY-OUTS FURNISHED

Prices Consistent With Good Work

Call, Write or Phone Walnut 7322

A. L. FISCHER

Room 813

1011 CHESTNUT STREET



Chartered 1836

Protect your Heirs with an
Insurance Trust. It is Safe,
Economical and Convenient.

Individual Trust Funds—\$373,000,000

GIRARD TRUST COMPANY

BROAD AND CHESTNUT STS. PHILADELPHIA

JOHN J. GRIFFIN & CO.

Manufacturers of

**GAS METERS
AND APPARATUS**

Repairing Promptly Attended to

**No. 1513 to 1521 Race Street
PHILADELPHIA**

Electrical Testing Laboratories

Electrical and Mechanical Laboratories

Tests of Electrical Machinery, Apparatus and Supplies.
Materials of Construction. Coal, Paper, etc. Inspection
of Material and Apparatus at Manufactories.

80th St. and East End Ave.

New York

HENRY BOWER

Chemical Manufacturing Company
YELLOW PRUSSIATES

SODIUM
CALCIUM

PHILADELPHIA

PENNSYLVANIA

INSURANCE OFFICE *of* HASELTINE SMITH

Fire, Life and General Insurance

326 WALNUT STREET

PHILADELPHIA

Bell Phone, Walnut 2694 Keystone Phone, Race 1020

GLYNN KOHLER PRINTING CO.

SUCCESSORS TO
BRADLEY PRINTING CO.

"Real Printing Service"

1029-1031 RACE STREET
PHILADELPHIA

High and Low Pressure
**STEAM FITTING
PLUMBING**

JOHN BORDEN AND BRO.
637 North 19th Street
Philadelphia

Electrical Insulation

FIBRE—Sheet, Tube, Rod, Specialties, Washers,
Discs, Track Insulation, Trucks, Cans.

SPECIALTIES—Varnished Cambric Cloth and Tape,
Resistance Wire, Cotton and Silk Tape, Insulating
Varnish, Mica, Waterproof Fibres, Varnished Tub-
ing, Large and Complete Stock "Diamond Fibre"
and Other Electrical Insulation Maintained.

Edgar O. Oeters Co.

605-7 Arch St.
PHILADELPHIA

206 Lafayette St.
NEW YORK

General Cement Contracting

Decorative-Architectural Precast
Concrete Made to Your Design and
in Stock

Garden Furniture

Jobbing Attended to

PHILIP WEISS

132 S. 7th Street Philadelphia, Pa.

Member of Amer. Concrete Institution



The Physics of the Air

By WILLIAM J. HUMPHREYS, Ph.D.

Professor of Meteorological Physics, United States Weather Bureau

A rational and deductive treatise on the physics of the atmosphere. Of great value to meteorologists, physicians and the aviator.

678 Pages, Illustrations, Index, Etc.

Price \$5.00 (Carriage extra.)

Address orders and inquiries to

THE FRANKLIN INSTITUTE

Philadelphia, U. S. A.

THE ELECTRON IN CHEMISTRY

**BEING FIVE LECTURES DELIVERED AT
THE FRANKLIN INSTITUTE
PHILADELPHIA**

By SIR J. J. THOMSON, O.M., F.R.S.

*MASTERS OF TRINITY COLLEGE AND PROFESSOR OF EXPERIMENTAL PHYSICS
IN THE UNIVERSITY OF CAMBRIDGE*

140 Pages, Illustrations, 8vo.

PRICE \$1.75 (Carriage extra.)

Address Orders and Inquiries to

**THE FRANKLIN INSTITUTE
PHILADELPHIA, U. S. A.**



THE
C. W. JOHNSON & COMPANY
PUBLISHERS

The Franklin Institute

Transportation
Library

OF THE

STATE OF PENNSYLVANIA

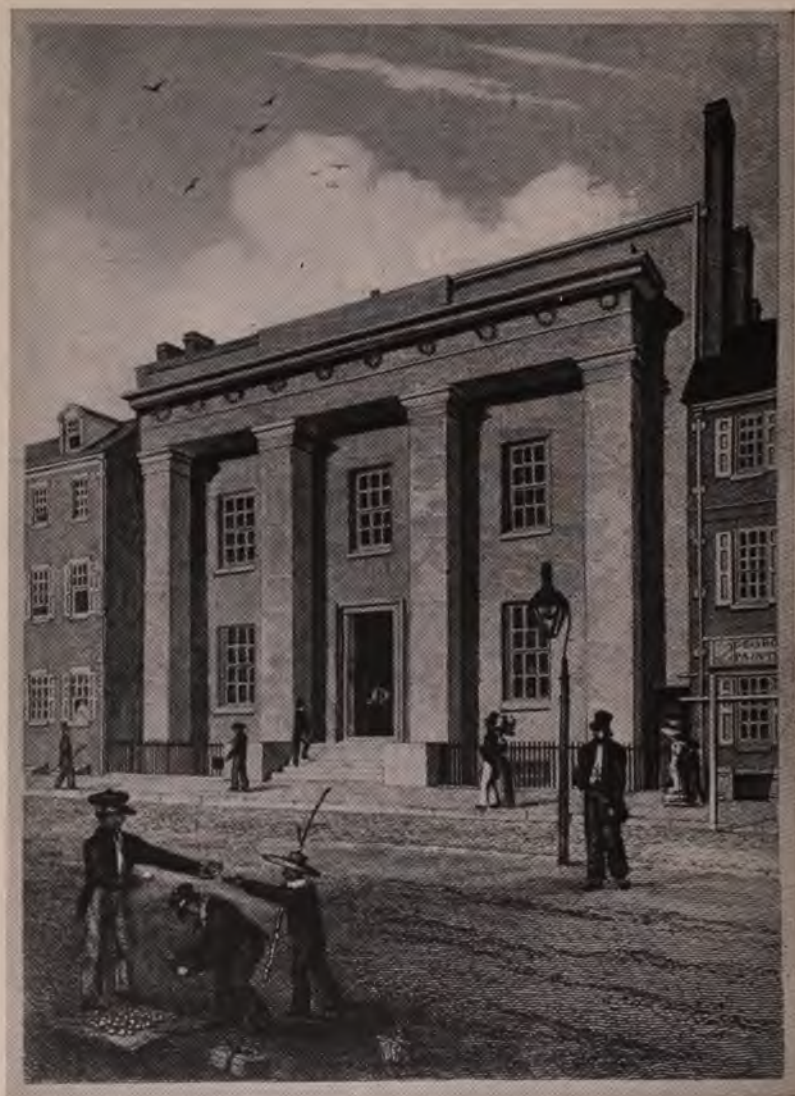
YEAR BOOK
1925—1926

TRANSPORTATION LIBRARY



UNIVERSITY OF MICHIGAN LIBRARIES





THE FRANKLIN INSTITUTE
1825

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

FOUNDED 1824

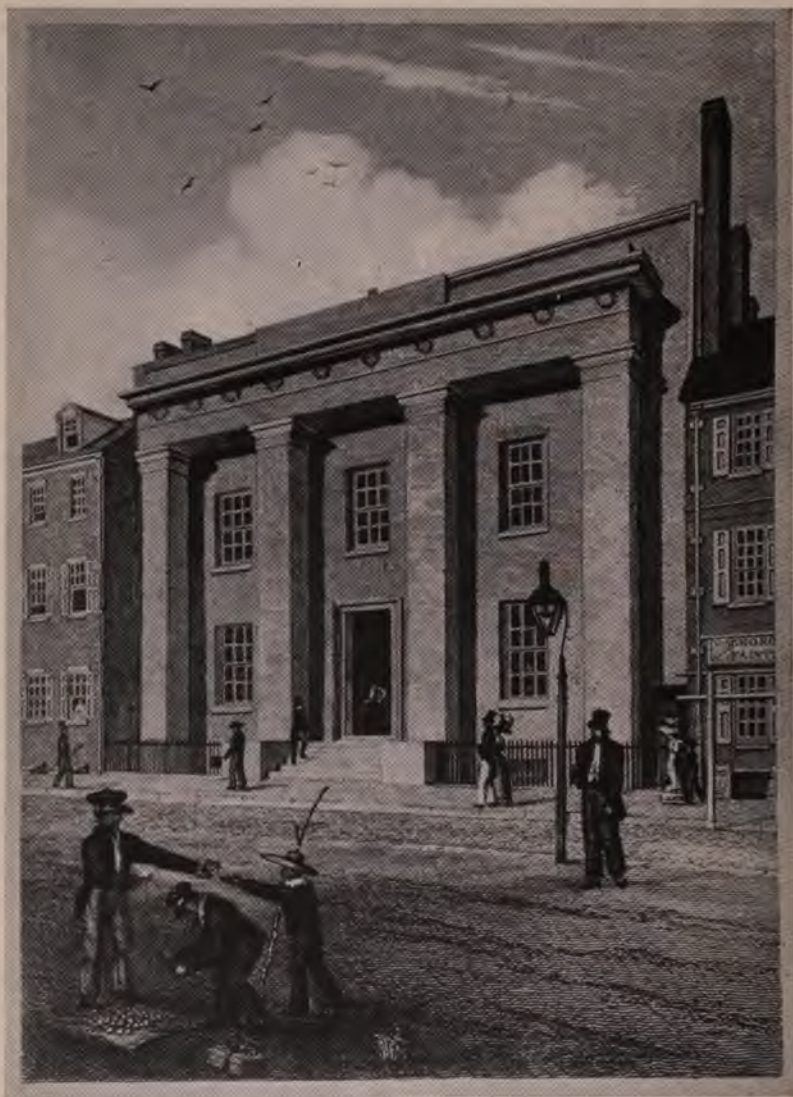
Year Book
1926

PHILADELPHIA

HALL OF THE INSTITUTE

15 SOUTH SEVENTH STREET

April 1, 1926



THE FRANKLIN INSTITUTE
1825

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

FOUNDED 1824

Year Book
1926

PHILADELPHIA

HALL OF THE INSTITUTE

15 SOUTH SEVENTH STREET

April 1, 1926



THE FRANKLIN INSTITUTE
1825

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

FOUNDED 1824

Year Book
1926

PHILADELPHIA

HALL OF THE INSTITUTE

15 SOUTH SEVENTH STREET

April 1, 1926

TELEPHONES

Bell, . . . Lombard 6846, 6847, 6848
Keystone, . . . Main 0160

CONTENTS

| | PAGE |
|--|------|
| OFFICERS AND COMMITTEES, 1926 | 5 |
| PAST OFFICERS, 1824-1926 | 11 |
| PAST CHAIRMEN, COMMITTEE ON SCIENCE AND THE ARTS, 1834-1926 . . | 18 |
| THE INSTITUTE'S ACTIVITIES | 19 |
| HISTORICAL EXTRACTS | 26 |
| CHARTER AND BY-LAWS | 42 |
| AWARDS BY THE INSTITUTE | 53 |
| REGULATIONS OF THE COMMITTEE ON SCIENCE AND THE ARTS | 59 |
| PRESIDENT'S REPORT AND REPORTS OF THE COMMITTEES OF THE INSTITUTE AND THE COMMITTEES OF ITS BOARD OF MANAGERS | 68 |
| THE FRANKLIN INSTITUTE AWARDS, 1925-1926 | 91 |
| THE FRANKLIN INSTITUTE AWARDS, 1835-1926 | 93 |
| TERMS AND PRIVILEGES OF MEMBERSHIP | 119 |
| MEETINGS AND LECTURES | 121 |
| BARTOL RESEARCH FOUNDATION LECTURES | 122 |
| MEMBERSHIP DIRECTORY | 124 |
| GEOGRAPHICAL DISTRIBUTION OF MEMBERS | 153 |

TELEPHONES

Bell, . . . Lombard 6846, 6847, 6848
Keystone, . . . Main 0160

CONTENTS

| | PAGE |
|--|------|
| OFFICERS AND COMMITTEES, 1926 | 5 |
| PAST OFFICERS, 1824-1926 | 11 |
| PAST CHAIRMEN, COMMITTEE ON SCIENCE AND THE ARTS, 1834-1926 . . | 18 |
| THE INSTITUTE'S ACTIVITIES | 19 |
| HISTORICAL EXTRACTS | 26 |
| CHARTER AND BY-LAWS | 42 |
| AWARDS BY THE INSTITUTE | 53 |
| REGULATIONS OF THE COMMITTEE ON SCIENCE AND THE ARTS | 59 |
| PRESIDENT'S REPORT AND REPORTS OF THE COMMITTEES OF THE INSTITUTE AND THE COMMITTEES OF ITS BOARD OF MANAGERS | 68 |
| THE FRANKLIN INSTITUTE AWARDS, 1925-1926 | 91 |
| THE FRANKLIN INSTITUTE AWARDS, 1835-1926 | 93 |
| TERMS AND PRIVILEGES OF MEMBERSHIP | 119 |
| MEETINGS AND LECTURES | 121 |
| BARTOL RESEARCH FOUNDATION LECTURES | 122 |
| MEMBERSHIP DIRECTORY | 124 |
| GEOGRAPHICAL DISTRIBUTION OF MEMBERS | 153 |



OFFICERS AND COMMITTEES, 1926

PRESIDENT

WM. C. L. EGLIN

VICE-PRESIDENTS

HENRY HOWSON

C. C. TUTWILER

WALTON FORSTALL

SECRETARY

HOWARD MCCLENAHAN

TREASURER

BENJAMIN FRANKLIN

BOARD OF MANAGERS*

JAMES BARNES

GEORGE H. BENZON, JR.

CHARLES E. BONINE

FRANCIS T. CHAMBERS

FRANCIS J. CHESTERMAN

G. H. CLAMER

THEOBALD F. CLARK

WALTON CLARK

CHARLES DAY

ARTHUR W. GOODSPEED

CLARENCE A. HALL

ALFRED C. HARRISON

NATHAN HAYWARD

GEORGE A. HOADLEY

ROBERT W. LESLEY

MARSHALL S. MORGAN

LAWRENCE T. PAUL

CHARLES PENROSE

JAMES S. ROGERS

GEORGE D. ROSENGARTEN

E. H. SANBORN

HASELTINE SMITH

J. T. WALLIS

WILLIAM CHATTIN WETHERILL

*The President, Vice-Presidents, Secretary, Treasurer and the Chairman of the Committee on Science and the Arts are *ex-officio* members of the Board of Managers.

ARCHITECT

JOHN T. WINDRIM

SOLICITORS

MORGAN, LEWIS AND BOCKIUS

OFFICERS AND COMMITTEES, 1926

PRESIDENT

WM. C. L. EGLIN

VICE-PRESIDENTS

HENRY HOWSON

C. C. TUTWILER

WALTON FORSTALL

SECRETARY

HOWARD MCCLENAHAN

TREASURER

BENJAMIN FRANKLIN

BOARD OF MANAGERS*

JAMES BARNES

GEORGE H. BENZON, JR.

CHARLES E. BONINE

FRANCIS T. CHAMBERS

FRANCIS J. CHESTERMAN

G. H. CLAMER

THEOBALD F. CLARK

WALTON CLARK

CHARLES DAY

ARTHUR W. GOODSPEED

CLARENCE A. HALL

ALFRED C. HARRISON

NATHAN HAYWARD

GEORGE A. HOADLEY

ROBERT W. LESLEY

MARSHALL S. MORGAN

LAWRENCE T. PAUL

CHARLES PENROSE

JAMES S. ROGERS

GEORGE D. ROSENGARTEN

E. H. SANBORN

HASELTINE SMITH

J. T. WALLIS

WILLIAM CHATTIN WETHERILL

*The President, Vice-Presidents, Secretary, Treasurer and the Chairman of the Committee on Science and the Arts are *ex-officio* members of the Board of Managers.

ARCHITECT

JOHN T. WINDRIM

SOLICITORS

MORGAN, LEWIS AND BOCKIUS

STAFF

HOWARD McCLENAHAN, E.E., M.S., LL.D., Secretary; Editor of the
JOURNAL OF THE FRANKLIN INSTITUTE.

ALFRED RIGLING, Assistant Secretary and Librarian; Assistant Editor,
JOURNAL OF THE FRANKLIN INSTITUTE.

WILLIAM F. JACKSON, Jr., Controller.

GEORGE A. HOADLEY, D.Sc., Secretary to the Committee on Science and
the Arts.

WALTER A. R. PERTUCH, Assistant Librarian.

ELIZABETH D. CONNELLY, Executive Assistant to the Secretary.

MARY L. COFFIN, Clerk to the Committee on Science and the Arts.

ISABELLA GRIFFITH, Bookkeeper.

CATHERINE MORRIS, Bookkeeper.

REGINA CRADDOCK, Secretary to Controller.

MARGARET A. BIRKETT, Secretary to Librarian.

EMMA EWING, Cataloguer.

CLAIRE JOHNSTON, Library Assistant.

MARY B. COBLE, Telephone Operator.

JAMES FRIEL, Office Assistant.

JOHN CONVERY, Library Clerk.

BARTOL RESEARCH LABORATORY

127-129-131 North Nineteenth Street

RESEARCH FELLOWS

ARTHUR BRAMLEY, Ph.D.

STAFF

OSCAR STEINER, Mechanician.

AUSTIN G. NESTER, Glass Blower.

WILLIAM HIRST, Apprentice.

COMMITTEES OF THE BOARD OF MANAGERS

EXECUTIVE COMMITTEE

| | |
|-------------------------|-----------------|
| E. H. SANBORN, Chairman | WALTON FORSTALL |
| G. H. BENZON, JR. | J. T. WALLIS |
| CHARLES DAY | |

COMMITTEE ON ENDOWMENT

| | |
|------------------------|-----------------------|
| G. H. CLAMER, Chairman | GEORGE D. ROSENGARTEN |
| BENJAMIN FRANKLIN | WM. CHATTIN WETHERILL |
| MARSHALL S. MORGAN | |

COMMITTEE ON FINANCE

| | |
|-----------------------------|--------------------|
| WALTON FORSTALL, Chairman | MARSHALL S. MORGAN |
| HENRY HOWSON, Vice-Chairman | E. H. SANBORN |
| BENJAMIN FRANKLIN | |

COMMITTEE ON MEMBERSHIP

| | |
|----------------------------|------------------|
| ROBERT W. LESLEY, Chairman | CLARENCE A. HALL |
| CHARLES E. BONINE | JAMES S. ROGERS |
| F. J. CHESTERMAN | |

COMMITTEE ON PUBLICATIONS

| | |
|-------------------------|-----------------------|
| E. H. SANBORN, Chairman | GEORGE A. HOADLEY |
| JAMES BARNES | WM. CHATTIN WETHERILL |
| CHARLES E. BONINE | |

Editorial Staff of the Journal

| | |
|---------------------------|----------------------------------|
| HOWARD MCCLENAHAN, Editor | ALFRED RIGLING, Assistant Editor |
|---------------------------|----------------------------------|

Associate Editors

| | |
|--------------------------|-----------------------------------|
| JOSEPH S. AMES | A. E. KENNELLY |
| WILDER D. BANCROFT | HENRY LEFFMANN |
| E. J. BERG | C. E. K. MEES |
| GEORGE K. BURGESS | RALPH MODJESKI |
| BRIG.-GEN. JOHN J. CARTY | R. B. MOORE |
| E. G. COKER | MAJ.-GEN. GEO. Q. SQUIER |
| A. S. CUSHMAN | W. F. G. SWANN |
| ARTHUR L. DAY | CHIEF CON. D. W. TAYLOR, U. S. N. |
| A. S. EVE | A. F. ZAHM |
| PAUL D. FOOTE | JOHN ZELENY |
| W. J. HUMPHREYS | |

BARTOL RESEARCH FOUNDATION COMMITTEE

| | |
|--------------------------|--------------------|
| C. C. TUTWILER, Chairman | NATHAN HAYWARD |
| E. P. ADAMS | MARSHALL S. MORGAN |
| JOSEPH S. AMES | CHARLES PENROSE |
| WALTON CLARK | C. R. RICHARDS |
| ARTHUR L. DAY | W. F. G. SWANN |

**SPECIAL COMMITTEE ON EXHIBIT AT SESQUI-CENTENNIAL
INTERNATIONAL EXPOSITION**

| | |
|------------------------|-----------------|
| HENRY HOWSON, Chairman | WALTON FORSTALL |
| JAMES BARNES | JAMES S. ROGERS |
| G. H. CLAMER | |

SPECIAL COMMITTEE ON ENDOWMENT AND BUILDING FUND

| | |
|------------------------------|-----------------------|
| WM. C. L. EGLIN, Chairman | HENRY HOWSON |
| HOWARD McCLENAHAN, Secretary | ROBERT W. LESLEY |
| F. J. CHESTERMAN | CHARLES PENROSE |
| WALTON CLARK | E. H. SANBORN |
| WALTON FORSTALL | C. C. TUTWILER |
| BENJAMIN FRANKLIN | WM. CHATTIN WETHERILL |

COMMITTEES OF THE INSTITUTE

COMMITTEE ON LIBRARY

| | |
|---------------------------|---------------------|
| W. H. FULWEILER, Chairman | JOSEPH S. HEPBURN |
| C. W. BATES | GEORGE A. HOADLEY |
| CHARLES E. BONINE | LIONEL F. LEVY |
| H. J. M. CREIGHTON | M. M. PRICE |
| CLARENCE A. HALL | GEORGE F. STRADLING |

COMMITTEE ON MEETINGS

| | |
|-----------------------------|-----------------------|
| HOWARD McCLENAHAN, Chairman | CHARLES PENROSE |
| JAMES BARNES | GEO. D. ROSENGARTEN |
| F. J. CHESTERMAN | COLEMAN SELLERS, 3RD |
| GEORGE S. CRAMPTON | W. F. G. SWANN |
| G. A. HOADLEY | WM. CHATTIN WETHERILL |

COMMITTEE ON MUSEUM

| | |
|------------------------|--------------------|
| HUGO BILGRAM, Chairman | GEORGE A. HOADLEY |
| G. H. BENZON, JR. | JOHN J. L. HOUSTON |
| ARTHUR L. CHURCH | HENRY LEFFMANN |
| THEOBALD F. CLARK | CHARLES PENROSE |
| CHARLES DAY | H. H. QUIMBY |

FRANKLIN FUND AND BUILDING COMMITTEE

| | |
|-------------------------|-------------------|
| HENRY HOWSON, Chairman | BENJAMIN FRANKLIN |
| WALTON CLARK, Treasurer | |

COMMITTEE ON SCIENCE AND THE ARTS

| | |
|----------------------------|---------------------|
| CLARENCE A. HALL, Chairman | THOMAS D. COPE |
| N. W. AKIMOFF | GEORGE S. CRAMPTON |
| HENRY B. ALLEN | H. J. M. CREIGHTON |
| JAMES BARNES | GEORGE S. CULLEN |
| CLIFFORD W. BATES | SAMUEL B. ECKERT |
| GEORGE H. BENZON, JR. | WM. C. L. EGLIN |
| HUGO BILGRAM | WILLIAM G. ELLIS |
| CHARLES E. BONINE | OWEN B. EVANS |
| WILLIAM L. BROWN, 3RD | J. LOGAN FITTS |
| HAROLD CALVERT | BENJAMIN FRANKLIN |
| G. H. CLAMER | W. H. FULWEILER |
| EDWARD L. CLARK | CHARLES D. GALLOWAY |
| THEOBALD F. CLARK | NATHAN HAYWARD |

COMMITTEE ON SCIENCE AND THE ARTS—(Continued)

| | |
|-----------------------|------------------------|
| JOSEPH S. HEPBURN | J. M. RUSBY |
| FREDERICK V. HETZEL | WILLIAM OTIS SAWTELLE |
| GEORGE A. HOADLEY | COLEMAN SELLERS, 3RD |
| W. N. JENNINGS | EDWARD W. SMITH |
| WILLIAM H. KAVANAUGH | JOHN C. TRAUTWINE, 3RD |
| LIONEL F. LEVY | C. C. TUTWILER |
| K. G. MACKENZIE | JAMES G. VAIL |
| CHAS. H. MASLAND, 2ND | JOHN A. VOGLESON |
| STEPHEN H. NOYES | FRANCIS R. WADLEIGH |
| FREDERIC PALMER, JR. | WALTER C. WAGNER |
| CHARLES PENROSE | JOHN M. WEISS |
| M. M. PRICE | HOWARD W. WELLES |
| H. H. QUIMBY | WM. CHATTIN WETHERILL |
| FRANK H. ROGERS | ROBERT L. WOOD |
| JAMES S. ROGERS | WINTHROP R. WRIGHT |
| L. F. RONDINELLA | |

Standing Sub-committees**The Franklin Medal**

| | |
|------------------------|--------------------|
| JAMES BARNES, Chairman | H. J. M. CREIGHTON |
| CHARLES E. BONINE | BENJAMIN FRANKLIN |
| G. H. CLAMER | |

Literature

| | |
|-----------------------------|--------------------|
| BENJAMIN FRANKLIN, Chairman | H. J. M. CREIGHTON |
| CHARLES E. BONINE | LIONEL F. LEVY |
| THOMAS D. COPE | J. M. RUSBY |

New Subjects and Preliminary Examination

| | |
|------------------------------|-----------------|
| H. J. M. CREIGHTON, Chairman | LIONEL F. LEVY |
| JAMES BARNES | CHARLES PENROSE |
| CHARLES E. BONINE | M. M. PRICE |
| GEORGE S. CRAMPTON | JAMES S. ROGERS |
| BENJAMIN FRANKLIN | JOHN M. RUSBY |
| NATHAN HAYWARD | |

PAST OFFICERS

1824-1926

PRESIDENTS

| | |
|--------------------------------|-------------------------------|
| BANES, CHARLES H., 1886 | ROGERS, ROBERT E., 1875-1878 |
| BIRKINBINE, JOHN, 1897-1906 | RONALDSON, JAMES, 1824-1841 |
| CLARK, WALTON, 1907-1923 | SELLERS, COLEMAN, 1870-1874 |
| CRESSON, JOHN C., 1855-1863 | SELLERS, WILLIAM, 1864-1866 |
| EGLIN, WM. C. L., 1924- | TATHAM, WILLIAM P., 1879-1885 |
| MERRICK, J. VAUGHAN, 1867-1869 | WILSON, JOSEPH M., 1887-1896 |
| MERRICK, SAMUEL V., 1842-1854 | |

VICE-PRESIDENTS

| | |
|--|--------------------------------------|
| AGNEW, JOHN, 1851, 1855-1863 | HEYL, HENRY R., 1895-1897 |
| ALLEMAN, GELLERT, 1924-1925 | HOWSON, HENRY, 1904- |
| BALDWIN, MATTHIAS W., 1855-1863 | JONES, WASHINGTON, 1900-1910 |
| BECK, PAUL, JR., 1826-1827 | LEVY, LOUIS E., 1916-1919 |
| BULLOCK, CHARLES, 1879-1900 | LONGSTRETH, EDWARD, 1890-1894 |
| CAREY, MATTHEW, 1824-1828 | LUKENS, ISAIAH, 1824-1825, 1829-1846 |
| CARTWRIGHT, HENRY, 1880-1881 | MILLER, ABRAHAM, 1847-1854 |
| CHRISTIE, JAMES, 1911 | MITCHELL, J. E., 1875-1887 |
| CLOSE, CHARLES S., 1875-1879 | MOORE, BLOOMFIELD H., 1869-1876 |
| CRESSON, GEORGE V., 1898-1903 | MORRIS, HENRY G., 1870-1879 |
| DAY, CHARLES, 1920-1923 | RAND, THEODORE D., 1897-1903 |
| DODGE, JAMES M., 1903-1915 | ROGERS, FAIRMAN, 1864-1866 |
| EGLIN, WM. C. L., 1922-1923 | ROGERS, ROBERT E., 1868-1874 |
| EREBY, GEORGE, 1867 | SELLERS, COLEMAN, 1867-1869 |
| FLETCHER, THOMAS, 1828-1850, 1852-1854 | SELLERS, COLEMAN, JR., 1912-1922 |
| FORSTALL, WALTON, 1926- | TATHAM, WILLIAM P., 1888-1897 |
| FRAZER, JOHN F., 1865-1866 | TOWNE, JOHN H., 1864-1868 |
| GRAFF, FREDERICK, 1882-1890 | TUTWILER, C. C., 1924- |

RECORDING SECRETARIES

| | |
|--------------------------------------|--------------------------------|
| BULKLEY, JAMES H., 1831-1832 | PEROT, WILLIAM S., 1833-1834 |
| GARRIGUES, ISAAC B., 1830, 1837-1863 | ROBERTS, ALGERNON S., 1829 |
| JONES, THOMAS P., 1827-1828 | STRICKLAND, WILLIAM, 1824-1826 |
| JONES, WASHINGTON, 1864 | TRAUTWINE, JOHN C., 1835-1836 |

CORRESPONDING SECRETARIES

| | |
|--------------------------------|--------------------------------|
| BACHE, ALEX. DALLAS, 1840-1844 | FRALEY, FREDERICK, 1855-1863 |
| BRIGGS, ROBERT, 1864 | FRAZER, JOHN F., 1845-1847 |
| BROWNE, PETER A., 1824-1827 | HAYS, ISAAC, 1828-1839 |
| CRESSON, JOHN C., 1854 | ROBERTS, SOLOMON W., 1848-1853 |

SECRETARIES

| | |
|--|--|
| CHRISTIE, JAMES, 1909 | MORTON, HENRY, 1865-1870 |
| HODLEY, GEORGE A. (Acting), 1917-1918, 1924-1925 | NORRIS, ISAAC, 1879-1881 |
| KNIGHT, J. B., 1875-1879 | OWENS, ROBERT B., 1910-1924 |
| MCCLENAHAN, HOWARD, 1925- | WAHL, WILLIAM H., 1871-1874, 1882-1908 |

TREASURERS

| | |
|---|-------------------------------|
| BORGNER, CYRUS, 1908-1920 | MERRICK, SAMUEL V., 1828-1829 |
| FLETCHER, THOMAS, 1824-1825 | RICHARDSON, JOHN, 1826-1827 |
| FRALEY, FREDERICK, 1830-1847, 1865-1882 | SARTAIN, SAMUEL, 1883-1906 |
| FRANKLIN, BENJAMIN, 1920- | TREGO, CHARLES B., 1847 |
| FRAZER, JOHN F., 1848-1864 | WAHL, WILLIAM H., 1907 |

ACTUARIES

| | |
|--|----------------------------------|
| CHRISTIE, JAMES, Feb. 21-June 11, 1908 | JESTER, SIMEON VAN T., 1916-1918 |
| HAMILTON, WILLIAM, 1828-1871 | LARZELERE, JAMES S., 1908-1916 |
| HEYL, HERBERT L., 1885-1908 | PARRISH, T. R., 1922-1924 |
| HOLMAN, DAVID S., 1872-1885 | ROBINSON, LOUIS C., 1918-1922 |
| JACKSON, WILLIAM F., JR., 1924-1925 | WAHL, WILLIAM H., 1872 |

LIBRARIANS

| | |
|--------------------------------|------------------------|
| HILTEBRAND, EMANUAL, 1874-1887 | RIGLING, ALFRED, 1887- |
|--------------------------------|------------------------|

CONTROLLERS

| |
|---------------------------------|
| JACKSON, WILLIAM F., JR., 1925- |
|---------------------------------|

MANAGERS

| | |
|-----------------------------------|---|
| ABBOT, WILLIAM, 1824-1826 | ARCHER, ELLIS S., 1858-1859 |
| ADAMSON, WILLIAM, 1864 | BACHE, ALEX. DALLAS, 1830-1839 |
| ADDICKS, JOHN E., 1845-1850 | BALCH, EDWIN S., 1902-1912 |
| AGNEW, JOHN, 1831-1850, 1852-1854 | BALDWIN, MATTHIAS W., 1827-1854 |
| ALLEMAN, GELLERT, 1918-1923 | BANES, CHARLES H., 1877-1885, 1887-1895 |
| ALLEN, JAMES, 1845 | BARKER, GEORGE F., 1874-1875 |
| ALLISON, WILLIAM C., 1863 | |

MANAGERS—(Continued)

- BARNES, JAMES, 1925-
 BARRAS, JOSEPH J., 1851-1860
 BARTOL, BARNABAS H., 1863-1865
 BARTOL, HENRY W., 1870-1878
 BAUGH, DANIEL, 1900-1902
 BAUGH, HARMAN, 1855
 BEALE, JOSEPH, 1827
 BEARDSLEY, ARTHUR, 1894-1902
 BECK, PAUL, JR., 1824-1825
 BEMENT, CLARENCE S., 1871
 BEMENT, WILLIAM B., 1866-1870
 BENZON, GEORGE H., JR., 1925-
 BERGNER, THEODORE, 1870-1875
 BETTS, WILLIAM C., 1844
 BIDDLE, CLEMENT C., 1824
 BILGRAM, HUGO, 1885-1890
 BIRKBECK, JOHN, 1869-1871
 BIRKINBINE, HENRY P. M., 1851-1856
 BIRKINBINE, JOHN, 1907-1915
 BOLTON, JAMES M., 1830
 BONINE, CHARLES E., 1921-
 BORGNER, CYRUS, 1903-1907
 BOSWELL, WILLIAM L., 1896-1898
 BOWER, HENRY, 1891-1896
 BRIGGS, ROBERT, 1867-1873
 BROCK, ROBERT C. H., 1901-1906
 BROLASKY, HENRY C., 1897-1902
 BRYSON, JAMES H., 1857-1863
 BULKLEY, JAMES H., 1830, 1833-1841
 BULLOCK, CHARLES, 1868-1878
 BURNHAM, GEORGE, 1878
 BURTIS, AARON H., 1845
 CARR, WILLIAM H., 1837-1845
 CARTWRIGHT, HENRY, 1865-1879
 CHABOT, CYPRIEN, 1877-1889
 CHAMBERS, CYRUS, JR., 1876-1890
 CHAMBERS, FRANCIS T., 1913-
 CHASE, PLINY E., 1864-1886
 CHRISTIE, JAMES, 1897-1908
 CLAMER, G. H., 1917-
 CLARK, THEOBALD F., 1917-
 CLARK, WALTON, 1903-1906, 1924-
 CLARKE, JAMES, 1824-1826
 CLOSE, CHARLES S., 1865-1874
 CLOUD, JOSEPH, 1824
 CODMAN, JOHN E., 1892-1894
 COLLINS, ISAAC, 1828
 CONARD, THOMAS P., 1894-1908
 CONARROE, GEORGE W., 1851-1863
 COOPER, JOHN H., 1870-1873
 COPPER, JOHN C., 1851
 CORNELIUS, ROBERT, 1855-1863
 CORNELIUS, ROBERT C., 1866-1868
 CRAMP, CHARLES H., 1864-1867, 1875,
 1895-1897
 CRESSON, GEORGE V., 1886-1897
 CRESSON, JOHN C., 1835-1853
 CRESSON, WILLIAM P., 1848-1849
 DARRACH, CHARLES G., 1894-1896
 DAY, CHARLES, 1908-1919, 1924-
 DIVINE, WILLIAM, 1864
 DODGE, JAMES M., 1896-1903
 DODGE, KERN, 1916-1920
 DONALDSON, JOSEPH, 1825
 DOUGHERTY, JAMES, 1858-1861
 DRAPER, EDMUND, 1847-1850
 DREER, FERDINAND J., 1862
 DROWN, WILLIAM A., 1861-1863
 DU BOIS, WILLIAM L., 1880-1882
 DURFEE, WILLIAM F., 1872-1873
 EASTWICK, ANDREW M., 1836-1844
 EASTWICK, EDWARD P., 1859-1860
 EBERT, MORRIS, 1908-1911
 ECKERT, GEORGE M., 1852-1854
 EGLIN, WM. C. L., 1908-1922
 EISENHUT, JOHN D., 1824-1825
 ELDRIDGE, G. MORGAN, 1885-1890
 ELLIS, JAMES P., 1848-1851

MANAGERS—(Continued)

- EMERSON, G., 1828
 EREBY, GEORGE, 1854-1866
 EVANS, OWEN, 1844-1857
 FERGUSON, ALEXANDER, 1831-1841
 FLETCHER, THOMAS, 1826-1827
 FLING, WILLIAM B., 1842
 FORSTALL, WALTON, 1908-1925
 FOX, GEORGE, 1828-1830
 FRALEY, FREDERICK, 1829, 1848-1854
 FRANKLIN, BENJAMIN, 1917-1919
 FRAZER, JOHN F., 1844, 1865-1866
 FRAZER, PERSIFOR, 1880-1891, 1903-1909
 FRAZIER, GEORGE H., 1898
 FRENCH, HOWARD B., 1900
 FRY, WILLIAM, 1825
 GARDINER, JOHN, JR., 1864
 GARRIGUES, ISAAC B., 1825-1829, 1831-1836
 GARRISON, F. LYNWOOD, 1890-1895, 1897-1903
 GAWTHROP, HENRY, 1896-1898
 GIBBS, ALFRED W., 1915-1922
 GIBSON, J. HOWARD, 1893-1894
 GIBSON, JOHN J., 1912-1915
 GILDER, JOHN, 1838-1841
 GILPIN, THOMAS, 1824
 GOBRECHT, CHRISTIAN, 1828-1830
 GOLDSMITH, E., 1908-1916
 GOODSPEED, ARTHUR W., 1925-
 GRAFF, FREDERICK, 1852-1854, 1858-1865, 1880-1881
 GRAHAM, HOWARD S., 1920-1921
 GREBLE, EDWIN, 1841-1863
 GREENE, STEPHEN, 1898-1908
 GRIES, JOHN M., 1858-1862
 GRIFFITH, R. EGGLEFIELD, 1870-1871
 GRIFFITH, ROBERT E., 1827
 GROVES, DANIEL, 1824-1827
 HALL, CLARENCE A., 1922-
 HAND, JAMES C., 1845-1846
 HANSELL, WILLIAM S., 1827
 HARDING, GEORGE, 1864-1865
 HARKER, JOSHUA G., 1831-1836
 HARPER, JAMES, 1824-1826
 HARRIS, WILLIAM, 1860-1863
 HARRISON, ALFRED C., 1895-
 HARRISON, C. LELAND, 1899-1902
 HARRISON, JOHN, 1824-1829
 HARRISON, JOSEPH, JR., 1854, 1856-1859
 HART, SAMUEL, 1865-1870
 HAVILAND, JOHN, 1824-1826
 HAYS, ISAAC, 1840-1841
 HAYWARD, NATHAN, 1917-
 HELLER, CHARLES S., 1879-1880
 HELME, WILLIAM, 1869-1888
 HENDERSON, GEORGE R., 1915-1921
 HERSE, GEORGE P., 1851
 HEXAMER, CHARLES A., 1904-1925
 HEYL, HENRY R., 1879-1895, 1898-1909
 HOADLEY, GEORGE A., 1911-
 HORN, HENRY, 1824
 HORSTMANN, WILLIAM J., 1865-1868
 HOUSTON, EDWIN J., 1874-1897
 HOWARD, GEORGE C., 1855-1858
 HOWE, HERBERT M., 1898-1900
 HOWSON, CHARLES HENRY, 1903-1907
 HOWSON, HENRY, 1898-1903
 HUFTY, SAMUEL, 1834-1850
 HUMPHREYS, SAMUEL, 1826
 HUNTER, JAMES, 1864
 HUTCHINSON, CHARLES H., 1888-1890
 HUTCHINSON, JAMES, 1841-1842
 HUTCHINSON, JOSEPH, 1860-1863
 JAYNE, HARRY W., 1891-1910
 JENNINGS, W. N., 1896
 JOHNSON, LAWRENCE, 1855-1859

MANAGERS—(Continued)

- JONES, THOMAS P., 1826
 JONES, WASHINGTON, 1859-1895, 1897-1900
 KATEZ, I., 1824
 KEATING, WILLIAM H., 1824-1826, 1830-1840
 KELLER, HARRY F., 1914-1924
 KELLY, HENRY H., 1851
 KING, ROBERT P., 1851
 KIRK, CHARLES H., 1830
 KIRKPATRICK, GEORGE E., 1911-1914
 KLUMPP, JOHN BARTLEMAN, 1923
 KNEASS, WILLIAM, 1825
 KNIGHT, DANIEL R., 1845
 KRUMBHAAR, ALEXANDER, 1898-1911
 KUHN, C. HARTMAN, 1896-1905
 LAMBERT, WM. H., 1906
 LESLEY, ROBERT W., 1913-
 LE VAN, W. BARNET, 1864-1876
 LEVY, LOUIS E., 1903-1915
 LEWIS, ENOCH, 1868-1894
 LEWIS, HARVEY, 1824-1827
 LEWIS, MORDECAI D., 1828-1836
 LINDSAY, JOHN, 1843
 LINDSAY, ROBERT, 1834-1836
 LINNARD, JAMES M., 1836-1838
 LINVILLE, J. HAYES, 1868
 LONGSTRETH, CHARLES, 1903-1907
 LONGSTRETH, EDWARD, 1868-1870, 1895-1897
 LOUD, THOMAS, 1829-1831
 LOVE, WILLIAM H., 1859
 LUCAS, JOHN, 1888-1894
 LUKENS, ISAIAH, 1828
 LUKENS, JAWOOD, 1902-1908
 LYMAN, BENJAMIN S., 1901-1902
 McALPINE, JAMES, 1825-1828
 McCAFFREY, E. V., 1910-1924
 McCAMBRIDGE, RICHARD, 1876
 McCCLURE, JOHN, 1853-1856
 McCCLURG, ALEXANDER, 1833-1839
 McEUEEN, THOMAS, 1829
 McKEAN, WILLIAM V., 1879-1883
 MARKS, WILLIAM D., 1881-1884
 MARSHALL, SAMUEL R., 1887-1893
 MASON, DAVID H., 1824
 MASON, JAMES S., 1861
 MEGARGE, CHARLES, 1858
 MEIRS, RICHARD WALN, 1908-1917
 MERRICK, J. VAUGHAN, 1864-1866, 1870-1884
 MERRICK, SAMUEL V., 1824-1827, 1830-1841, 1855-1863
 MIFFLIN, LLOYD, 1825-1826
 MILES, FREDERICK B., 1874
 MILLER, ABRAHAM, 1824-1846, 1855-1858
 MITCHELL, J. E., 1874
 MITCHELL, WILLIAM A., 1864-1865
 MOORE, BLOOMFIELD H., 1864-1868
 MOORE, JOSEPH W., 1860-1861
 MORGAN, MARSHALL S., 1914-
 MORRIS, ELWOOD, 1844-1847
 MORRIS, HENRY G., 1864-1869
 MORRIS, ISAAC P., 1836-1843
 MORRIS, WILLIAM E., 1847-1851
 MUCKLE, M. RICHARDS, JR., 1894-1896
 NAYLOR, JACOB, 1863, 1865-1872
 NEAFIE, JACOB G., 1868
 NEWHALL, PAUL W., 1843-1844
 NORRIS, ISAAC, 1870-1878, 1883-1918
 NYSTROM, JOHN W., 1873-1875
 OGDEN, JOHN M., 1833
 OGLE, WILLIAMS, 1845-1850
 O'NEILL, JOHN, 1827-1832
 ORR, HECTOR, 1871-1887
 OUTERBRIDGE, ALEX. E., JR., 1881-1886
 PALMER, B. FRANKLIN, 1862

MANAGERS—(Continued)

- PARRISH, WILLIAM D., 1838, 1852-1854
- PARRY, CHARLES T., 1864
- PATTERSON, ROBERT, 1824
- PATTERSON, ROBERT M., 1825-1827
- PAUL, LAWRENCE T., 1895-
- PEMBERTON, HENRY, JR., 1891-1896
- PENROSE, CHARLES, 1925-
- PERRY, ROBERT S., 1912-1916
- PETTIT, HORACE, 1894-1910
- PURVES, ALEXANDER, 1875-1876
- RALSTON, ASHBEL G., 1825-1830
- RAMAGE, ADAM, 1824-1832
- RAND, THEODORE D., 1874-1897
- REED, WILLIAM B., 1832-1836
- REEVES, BENJAMIN, 1829-1837
- REEVES, SAMUEL J., 1864
- REEVES, STACY, 1889-1902
- RICE, JOHN, 1866-1867
- RICHARDS, MARK, 1831
- RICHARDSON, JOHN, 1825
- RIEHLE, HENRY J., 1826-1827
- ROBBINS, SAMUEL J., 1827-1833
- ROBERTS, ALGERNON S., 1828
- ROBERTS, PERCIVAL, 1864-1868
- ROBERTS, SOLOMON W., 1842-1847
- ROBINSON, ALEXANDER P., 1911-1916
- ROGERS, EVANS, 1854-1863
- ROGERS, HENRY D., 1838-1843
- ROGERS, JAMES S., 1909-
- ROGERS, ROBERT E., 1867
- RONALDSON, CHARLES E., 1885-1893, 1908-1912
- ROSENGARTEN, GEORGE D., 1912-
- ROWLAND, JAMES, JR., 1829-1830
- ROWLAND, WILLIAM, 1828
- RUSH, WILLIAM, 1825
- RUST, JAMES I., 1824
- SADTLER, SAMUEL P., 1888-1897
- SANBORN, E. H., 1907-
- SARTAIN, JOHN, 1877-1879
- SARTAIN, SAMUEL, 1865-1882
- SAVERY, PELEG B., 1851-1852
- SAXTON, JOSEPH, 1842-1844
- SAY, BENJAMIN, 1832-1833
- SCATTERGOOD, THOMAS, 1829-1834
- SCHAUM, OTTO W., 1907
- SCHREINER, JOSEPH H., 1827-1832
- SCHUMANN, FRANCIS, 1899-1902
- SEIPER, THOMAS, 1824
- SELLERS, COLEMAN, 1862-1866, 1875-1905
- SELLERS, COLEMAN, JR., 1906-1911
- SELLERS, WILLIAM, 1857-1861, 1867-1892
- SHAIN, CHARLES J., 1884-1887
- SHINN, EARLE, 1836-1837
- SLOAN, SAMUEL, 1864
- SMITH, CHARLES E., 1852-1855
- SMITH, HASELTINE, 1922-
- SOUDER, JACOB, 1828
- SPANGLER, HENRY W., 1891-1893
- STEVENSON, WILLIAM, JR., 1828
- STEWART, THOMAS S., 1842-1850, 1852-1863
- STRICKLAND, WILLIAM, 1828
- STRUTHERS, JOHN, 1827-1849
- TABER, GEORGE, 1839-1842
- TATHAM, WILLIAM P., 1870-1878, 1886-1887
- THOMPSON, AMBROSE W., 1839-1843
- THOMSON, ELIHU, 1878-1881
- THORNE, WILLIAM H., 1881-1897
- THORNLEY, JOHN, 1851
- TILGHMAN, BENJ. C., 1871-1875
- TOPPAN, CHARLES, 1831-1832
- TOWNE, JOHN H., 1840-1857, 1869
- TOWNSEND, EDWARD Y., 1866-1867

MANAGERS—(Continued)

- TRACY, ELIASHIB, 1851
 TRAUTWINE, JOHN C., 1834, 1844,
 1852-1857
 TRAUTWINE, JOHN C., JR., 1891-1895
 TREGO, CHARLES B., 1837-1846
 TREVOR, JOHN B., 1832
 TROTH, HENRY, 1837-1841
 TRYSON, GEORGE W., 1831-1833
 TUTWILER, C. C., 1920-1923
 TYLER, RUFUS, 1826-1837
 VAUCLAIN, SAMUEL M., 1898, 1906
 VAUX, GEORGE, JR., 1898-1899
 WALLIS, J. T., 1923-
 WALTER, JOSEPH S., JR., 1834-1837
 WALTER, THOMAS U., 1829-1831,
 1840-1851
 WARDER, WILLIAM S., 1825-1827
 WARNER, JOHN S., 1837-1843
 WEAVER, JACOB, 1856-1857
 WEAVER, JOHN J., 1880-1891
 WEIGHTMAN, WILLIAM, 1862-1863
 WETHERILL, CHARLES, 1835
 WETHERILL, J. P., 1902
 WETHERILL, JOHN P., 1824-1825
 WETHERILL, WILLIAM, 1832
 WETHERILL, WILLIAM C., 1916-
 WEYGANDT, THOMAS J., 1851-1863
 WHARTON, WILLIAM, JR., 1871
 WHITAKER, GEORGE P., 1851-1852
 WHITE, CHARLES H., 1828-1835
 WHITE, SAMUEL S., 1864-1867
 WHITNEY, ASA, 1846-1850
 WHITNEY, GEORGE, 1858-1860
 WHITNEY, JAMES S., 1862-1863, 1865-
 1869
 WHITNEY, JOHN R., 1861
 WICKHAM, M. T., 1824
 WIEGAND, JOHN, 1831-1853
 WIEGAND, S. LLOYD, 1864, 1890-1893
 WILLIAMS, EDWARD H., 1871-1872
 WILLIAMS, ISAAC S., 1846-1850, 1852-
 1863
 WILSON, JOSEPH M., 1869-1886
 WILSON, O. HOWARD, 1864-1869
 WOLBORN, CORNELIUS A., 1844-1850
 WOLF, OTTO C., 1897-1913
 WOOD, ALAN, 1845-1863
 WOOD, SAMUEL R., 1824-1825
 WOOD, WALTER, 1903-1912
 WOOTTEN, JOHN E., 1860-1862
 YARDLEY, WILLIAM, JR., 1829
 YEAGER, JOSEPH, 1832
 YOUNG, ANDREW, 1828-1830

PAST CHAIRMEN OF THE COMMITTEE ON SCIENCE AND THE ARTS, 1834-1926

| | |
|--|---|
| BACHE, ALEXANDER D., 1834-1836, 1839-1844 | HEYL, HENRY R., 1882-1887, 1893- 1894, 1900-1901 |
| BARNES, JAMES, 1922-1923 | HOADLEY, GEORGE A., 1911-1912 |
| BEARDSLEY, ARTHUR, 1892-1895 | KOENIG, G. A., 1888-1889 |
| BENZON, GEORGE H., JR., 1924-1925 | LEVY, LOUIS E., 1901-1902 |
| BILGRAM, HUGO, 1906-1907 | LEWIS, WILFRED, 1912-1913 |
| BONINE, CHARLES E., 1916-1917 | MARBURG, EDGAR, 1899-1900 |
| CALVERT, HAROLD, 1925-1926 | MARKS, W. D., 1881-1882, 1887-1888 |
| CHRISTIE, JAMES, 1897-1898 | MASLAND, CHARLES W., 1921-1922 |
| CLAMER, G. H., 1915-1916 | MCCONNELL, JACOB Y., 1909-1910 |
| CONARD, THOMAS P., 1902-1903 | ORR, HECTOR, 1880-1881 |
| CREIGHTON, H. JERMAIN, 1918-1919 | PATTERSON, R. M., 1836-1839 |
| CRESSON, J. C., 1844-1874 | PENROSE, CHARLES, 1920-1921 |
| CRISFIELD, J. A. P., 1913-1914 | ROGERS, JAMES S., 1908-1909 |
| ELDRIDGE, G. MORGAN, 1896-1897 | RONALDSON, CHARLES E., 1903-1904 |
| FRANKLIN, BENJAMIN, 1919-1920 | RONDINELLA, L. F., 1898-1899 |
| FULWEILER, W. H., 1923-1924 | SARTAIN, SAMUEL, 1895-1896 |
| GOLDSMITH, EDWARD, 1905-1906 | SELLERS, COLEMAN, 1875-1880 |
| GRIGGS, WILLIAM O., 1907-1908 | SPANGLER, H. W., 1890-1891 |
| HALL, CLARENCE A., 1926- | SPENCER, THOMAS, 1910-1911 |
| HAUPT, LEWIS M., 1904-1905 | WETHERILL, WM. CHATTIN, 1917-1918 |
| HENDERSON, GEORGE R., 1914-1915 | WIEGAND, S. LLOYD, 1889-1890, 1891- 1892 |

THE INSTITUTE'S ACTIVITIES

THE FRANKLIN INSTITUTE was organized in the year 1824 to meet a demand in America for an Institution similar to that founded by Count Rumford in London in 1799. The founders intended it not only as an appropriate memorial to the name of Franklin, but as a means of continuing for all time a work which throughout his long life he perhaps regarded as his best, namely, the discovery of physical and natural laws and their application to increase the well-being and comfort of mankind.

The Hall of the Institute is located on the east side of Seventh Street, between Market and Chestnut Streets, and was built from plans furnished by John Haviland, architect. The corner-stone was laid with appropriate Masonic and other ceremonies, on the eighth day of June, 1825, at noon. The funds for the purchase of the lot and the erection of the building were provided by the issue of a building loan, which was freely taken by members and friends of the enterprise, and has long since been repaid. The building was completed, and the Institute took possession of all except the second floor (which was occupied by the United States Courts until 1830) in 1826. Upon the first floor are located the lecture-room (capable of accommodating about 300), and laboratories and offices. The second floor is occupied by the library, to which special attention is paid elsewhere. The third floor is given up entirely to the Museum of Models and Historical Apparatus.

THE LIBRARY

The plan of the founders contemplated "the formation of a library of books relating to science and the useful arts, and the opening of a reading-room"; and, accordingly, in 1827, the first Committee on Library was appointed.

The books forming the nucleus of the library were stored in the residence of a member of the committee until early in the year 1829, when the first reading-room was opened. During the next year a special committee of twenty issued an appeal for books and contributions of money in aid of the library.

The founding of the JOURNAL, in 1826, by opening the way to the establishment of exchange relations with other societies and with the leading magazines and periodicals devoted to science and the useful arts, proved an invaluable help in promoting its growth, and thus, early, gave to the library the distinctive character which it has since maintained. From the nucleus formed by this useful agency has grown a reference library of scientific literature, in some branches unique, and, in extent and completeness, second to none in the United States, embracing the publications of the principal scientific and technical societies of the world, and the leading periodicals devoted to science and the arts.

Several of the foreign governments have deposited with the library complete sets of their patent office publications. There are on the shelves for reference files of the specifications of the patent office of Great Britain since the year 1617, of Switzerland since 1888, of the United States since 1790. The specifications of French patents 1791 to 1900 and abstracts of the patents

granted by Germany, Russia, Canada, Australia, Hungary and Austria can also be consulted.

The library is annually enriched, also, by the gift of numerous technical publications of a miscellaneous character from foreign governments, and from states and municipal authorities and corporations. These embrace publications relating to public works; official reports relating to geology, the mining and metallurgical industries, agriculture, public health, municipal engineering; reports of railway and other transportation companies, manufacturing corporations, etc.

For many years it has been the policy of this committee to increase the value of the collection as a library of reference, and to this end it has devoted systematic efforts to the task of completing the files of its important serial publications. In this work, the committee, with the substantial assistance of several liberal contributions of money from generous friends of the Institute, has been notably successful.

At the present time the collection consists of 83,927 volumes and 22,183 pamphlets.

To inventors and manufacturers seeking for information respecting the state of the arts and manufactures, the extensive collection of patent literature which the library places at their disposal is indispensable, and the library is constantly resorted to by attorneys and their clients for the purpose of consulting these volumes; while, to the professional man and the student, the scientific and technical serials in which the library is so rich are no less indispensable as an aid in pursuing the investigations.

The library is open daily from 9 o'clock A.M., until 5 o'clock P.M., Saturdays twelve o'clock noon. The Institute is closed on all state and national holidays.

THE COMMITTEE ON SCIENCE AND THE ARTS

A branch of the Institute's work, which, perhaps, more obviously than any other, illustrates the spirit which animated the founders, and which their successors have worthily perpetuated and striven to improve and extend, is that which is now conducted by the Committee on Science and the Arts.

One of the things that was, apparently, uppermost in the thoughts of the founders, was the need—as urgent then as to-day—felt by inventors and discoverers, of some competent, trustworthy and impartial body, to whom they could safely appeal for advice, and on whose judgment they could confidently rely for an opinion as to the usefulness of their inventions and discoveries.

One of the first acts of the Board of Managers was to appoint a Board of Examiners, whose duty it was to examine and make report upon all new and useful machines, inventions and discoveries submitted to them. Subsequently the name of the Board of Examiners was changed to the "Committee on Inventions."

This organization continued in existence until the year 1834, when, by act of the Institute, it was abolished, and in its place there was established the "Committee on Science and the Arts," with enlarged powers and a wider field of labor. As originally constituted, membership in this committee was open to all members of the Institute in good standing who chose to enroll their names, and who by thus voluntarily associating themselves with the committee, pledged themselves to perform the duties assigned to them.

Under this form of organization the committee continued for more than fifty years, and its usefulness during this long period is attested by its records, containing the results of the examination of a great number of inventions, and of its investigations of many subjects of importance entrusted to it by the Institute.

In the year 1886, the Institute adopted an amendment to its by-laws, by which this committee was reorganized on an elective basis, thus abolishing the plan of voluntary association which had heretofore been a distinguishing feature. By this amendment the Institute established a Committee on Science and the Arts, to be composed of forty-five members of the Institute, to be chosen at the annual election (fifteen each year), and "who shall pledge themselves by their acceptance of membership to perform such duties as may devolve upon them, and to sustain by their labors the scientific character of the Institute."

Some years later the membership of the committee was increased from forty-five to sixty and by a provision recently adopted the members are elected by the Board of Managers, twenty each year.

During the past twenty-five years the committee has investigated nearly 1000 discoveries, processes, and inventions.

THE JOURNAL

The publication of a journal for the diffusion of knowledge on all subjects connected with science and the useful arts, was embraced in the plan of the founders, and was undertaken shortly after the organization had been effected. This publication has been continued without interruption to the present time, and has proved most useful, not only in directly promoting the aims and objects of the Institute, but also in extending the sphere of its influence beyond the limits of its local habitation.

The first step to secure a publication was taken by the Institute as early as 1825, when, by arrangement with C. S. Williams, publisher, a magazine bearing the title *The American Mechanics' Magazine*, and which had been founded by him in New York at the beginning of that year, was acquired by Dr. Thomas P. Jones, who had recently been elected professor of mechanics in The Franklin Institute. At the outset the responsibility of this venture appears to have been assumed by Dr. Jones, after he had received assurances of active coöperation and support from the members of the Institute, who were warmly interested in its success.

The prospectus of the new publication, which was issued August 1, 1825, announced the fact that "shortly will be published

THE FRANKLIN JOURNAL AND MECHANICS' MAGAZINE,

UNDER THE PATRONAGE OF

THE FRANKLIN INSTITUTE, OF THE STATE OF PENNSYLVANIA, FOR THE PROMOTION OF THE
MECHANIC ARTS, EDITED BY DR. THOMAS P. JONES, PROFESSOR OF
MECHANICS IN THE INSTITUTE."

The object of *The Franklin Journal*, as defined in the prospectus, was, "to diffuse information on every subject connected with useful arts."

In the prospectus of *The Franklin Journal* attention is called to the fact that it was intended to give a list of patented inventions, with remarks upon their utility and originality. This proposition was literally maintained and continued as a prominent feature of the JOURNAL to the close of 1859, save that the "Remarks," which were in many cases of the greatest value to those interested in the progress of the arts and manufactures, were discontinued on the death of Dr. Jones. His accession to the position of Superintendent of the Patent Office naturally caused him to devote special attention to the preservation of the record of patents in the pages of the JOURNAL. This circumstance has since proved of considerable value to all who have need to refer to the early patents of the United States, as will appear from the following explanation:

In the official Patent Office publications, issued by the Government prior to the year 1843, the publication of the claims was omitted; while, for a considerable period, the JOURNAL published an abstract of the specifications and the claims in full. The JOURNAL, consequently, is the only source at present available for reference to the specifications and claims of patents issued by the United States from 1828 to 1842, inclusive. The JOURNAL can also be used, in place of the official publications, as a source of reference to the patents granted during the period 1826-1859 in which the patent lists were published therein.

The complete file of the JOURNAL embraces *The Franklin Journal*, 1826-1827, and the JOURNAL OF THE FRANKLIN INSTITUTE, 1828 to the present time, 201 volumes in all, with a General Index, 1826 to 1885, and three decennial volumes covering the years 1886 to 1915, inclusive.

In its present form, the JOURNAL is an octavo of about 150 pages. It is published monthly, the twelve impressions being divided into two volumes yearly—January to June and July to December, each separately paged, and supplied with title-page and index.

INSTRUCTION

The first Board of Managers of the Institute provided for the establishment of a standing Committee on Instruction, charged with the duty of directing its educational work.

This committee was appointed on March 4, 1824, and speedily perfected plans for systematic instruction by means of lectures and demonstrations. Professorships in chemistry, in natural philosophy and mechanics, and in architecture were established and filled by the election of capable instructors.

Provision was next made for the instruction of mechanics and apprentices and those engaged in the useful trades, and early in the fall of 1824 a school of mechanical and architectural drawing was established. This experiment seems to have been crowned with complete success; and the managers proceeded to establish another school, in which should be taught "all the useful branches of English literature and the ancient and modern languages." This project was realized in 1826. In 1827 over three hundred scholars were upon its

roll. It was the model upon which the Central High School, shortly afterwards established by the city as part of the public school system, was patterned. The drawing school was continued, and maintained an uninterrupted existence for ninety-nine years. Its leading feature—that of training pupils for actual work in shop and office—was always rigorously preserved.

Twenty-seven years ago classes in mathematics were established; these later became a part of the school of machine design. Instruction in naval architecture was first given in October, 1899.

All departments of instruction were united in the year 1910 and known as the School of Mechanic Arts.

For a period of ninety-nine years the Institute afforded educational training of a high order to many thousands of young men who, judging by many notable successes, benefited greatly by such training. The educational function of the Federal Government, State and City having been extended to cover fully the Institute's field of effort in vocational training, the work of its school has been suspended.

LECTURES

These have always occupied a prominent place in the scheme of the Institute's work, from the beginning to the present.

The first course was given in the old Academy Building, on Fourth Street, near Arch, owned by the University of Pennsylvania, the use of which for this purpose was granted by the trustees; and the work of the professors was ably supplemented by a corps of volunteer lecturers from the membership of the Institute. A little later, the Institute rented the lower floor of the old Carpenters' Hall for this purpose, and finally, on the completion and occupancy of the hall, the lectures were held in its own lecture room.

For many years the lectures were of the nature of regular courses on architecture, mechanics, physics, and chemistry, varied of course from year to year, but following generally the plan of graded or consecutive instruction, as in schools and colleges. This system, however, though for a long period admirably useful in meeting the needs of the public, was found in time to be gradually outgrowing its usefulness. Lecture courses on scientific themes, which for years had been practically preëmpted by The Franklin Institute, in time were made attractive features in the schools and colleges, and the popular science lecturer became a conspicuous figure on the public lecture platform. And so it came about, naturally, that the Committee on Instruction found it advantageous gradually to modify its plans to adapt them to the changes of the times. For a number of years, accordingly, the character of the Institute lectures has departed widely from the old-time pattern. The object at present most conspicuously kept in view in the selection of the lectures is to give the members of the Institute the advantage of having presented to them the latest advances in the useful arts and the sciences bearing thereon; and, to this end, the committee's efforts each year are directed to the purpose of securing the services of men of eminence in their respective fields of labor, who are invited to select their own themes. Since its foundation, The Franklin Institute has given free to the public thousands of lectures by distinguished scientists and technologists on scientific and

technological subjects in addition to numerous popular and illustrated addresses on subjects of immediate interest to the public and germane to the topics of the day.

MEETINGS

General meetings of the Institute's entire membership are held once each month, except during the summer. At these meetings great inventions and discoveries, important engineering projects, and notable achievements in all fields of scientific progress are presented, exhibited or discussed. Many of the epoch-making inventions have been shown in their experimental stages at these meetings—as the phonograph, the electric light, the typewriter, liquid air apparatus, machine telegraphy, etc.

EXHIBITIONS

As a means of promoting the mechanic arts, the holding of exhibitions was highly favored by the founders, and in this field of activity the Institute, for many years, was conspicuously prominent.

The first exhibition of American manufactures was held in October, 1824, in Carpenters' Hall.

This, it should be remembered to the credit of the Institute, was the first of the kind to be undertaken in this country.

The exhibitions of the Institute were held yearly or biennially, down to the year 1858. Many of the earlier events took place in the old Masonic Hall, on Chestnut Street, above Seventh, and in a temporary annex thereto; and the more recent ones in the one-time famous Museum Building, at Ninth and Sansom Streets, the destruction of which by fire, in the year 1850, made it necessary for the managers, for several years, to adapt themselves to less desirable quarters, and finally to discontinue the exhibitions for a time for want of a centrally located building suitable for the purpose.

In the year 1874 occurred the fiftieth anniversary of The Franklin Institute, and a fortunate circumstance enabled the managers to signalize the event by holding an exhibition, which proved from every point of view an eminently successful one. The circumstance spoken of was the fact that the Pennsylvania Railroad Company placed at the service of the Institute, for exhibition purposes, the old building at Thirteenth and Market Streets, for many years occupied as a freight station. Over 268,000 visitors attended this exhibition.

Successful, however, as was the exhibition of 1874, it was eclipsed in brilliancy, and in value from the educational and technical standpoint, by that of 1884, which will ever be memorable in the annals of The Franklin Institute. This was the Electrical Exhibition, held in the autumn of that year, under the direction of the Institute, and which by Act of Congress, approved February 26, 1883, was made international in character. It was the first exhibition in America devoted exclusively to the electrical arts.

In 1885 the Novelties Exhibition was held in the building erected for the electrical exhibition.

No further exhibitions have been held since that time, though the Institute coöperated with the Commercial Museum of Philadelphia in the management of the National Export Exposition of 1899.

MODELS AND HISTORICAL APPARATUS

This collection includes the electrical machine used by Doctor Franklin in his experiments in Philadelphia, his imposing stone and table for dressing type; Doctor Priestley's air pump, brought by him to America in 1794; odometer used by Doctor Franklin when postmaster-general of the colonies and by Thomas Jefferson; George M. Phelps' printing telegraph apparatus; magneto-electric machine made by Joseph Saxton and exhibited by him at the meeting of the British Association for the Advancement of Science in 1833; Oertling balance made about 1840; model of Oliver Evans' first high-pressure steam engine, made by Rush and Muhlenberg; model of George Stephenson's "No. 1" locomotive built for the Stockton and Darlington Railroad.

There are also numerous examples of metering devices for water, air, gas and electricity; photographic apparatus; typing and calculating machines and philosophical apparatus, the whole illustrative of the genius for discovery and invention that have made the past century notable in the history of science and its application in the industries.

HISTORICAL EXTRACTS

(CHRONOLOGICALLY STATED)

About a century ago there lived in Philadelphia two young men who independently conceived the idea of founding an American institution for promoting knowledge of physical science and its diffusion in the arts and industries. One of them was Samuel V. Merrick, then not quite twenty-one years old, and the other was Prof. William H. Keating of the University of Pennsylvania.

Mr. Merrick issued several calls for meetings for the consideration of the project, but no one attended.

Professor Keating had completed his scientific training in France and Switzerland and had returned to the United States full of zeal for the diffusion of science applied to agriculture and the mechanic arts. He was immediately appointed to the newly created chair of Chemistry in its application to Agriculture and the Mechanic Arts, at the University of Pennsylvania, and while thus engaged sought to interest his friends and others in his plans for a scientific and technical society. Mr. Merrick and Professor Keating comparing notes agreed to make another effort to hold another meeting for purposes they both had in mind.

Six gentlemen attended this meeting and a committee was appointed to draft a plan of organization, constitution, etc.

A small meeting was held, a plan approved, and Mr. Merrick and Professor Keating set about to carry it into execution.

Four of the committee selected from 1200 to 1600 names of citizens from the City Directory and invited them to attend another meeting to be held at the county court house at Sixth and Chestnut Streets, Philadelphia, on the evening of February 5, 1824.

The court house was filled to overflowing and from this meeting dates the founding of The Franklin Institute.

1824, February 5. First public meeting held in the county court house, Sixth and Chestnut Streets, for the purpose of organizing The Franklin Institute. A constitution was adopted and a day fixed for the election of officers.

March 4. Committee on Lectures appointed and the Chair of Mineralogy and Chemistry established.

March 30. An act to incorporate The Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts passed by the Legislature and signed by the Governor.

Dr. William H. Keating, Professor of Mineralogy and Chemistry, delivered the first lecture of the first course in the Academy Building, Fourth Street, below Arch, in April.

A Drawing School for members' sons and apprentices was opened in October. John Haviland, professor in charge, assisted by Hugh Bridport, artist and painter of miniatures.

October 18, 19 and 20, first exhibition of products of American industry held in Carpenters' Hall. Thirty premiums were offered for specimens of

blister steel, bar iron, broadcloths, domestic carpetings, etc. Three hundred exhibits; ten silver medals and two bronze medals were awarded.

1825, April 4. A Mathematical School for members, their sons and apprentices was opened under the direction of Mr. Levi Fletcher.

June 8. This day at high 12 o'clock the corner-stone of the Hall of The Franklin Institute was laid in ancient and Masonic form by the Grand Lodge of Pennsylvania in the presence of the Society. After the appropriate ceremonies had been performed by the Grand Master, prayers were offered up by the Rev. C. G. Potts, Grand Chaplain. The Grand Treasurer deposited in the cavity of the Stone a glass cylinder hermetically sealed containing:

The constitution and by-laws of The Franklin Institute with their first annual report and list of Members, etc.

Medal of William Penn and the Indian chief, sitting under a tree smoking the calumet of peace, on the reverse the allseeing eye, inscribed "Let us look to the Most high who blessed our fathers with peace."

Head of Washington inscribed "George Washington: Commission resigned—Presidency relinquished—1797."

A Silver Medal, with the head of James Monroe, Late President of the United States. On reverse: The Hands of an American officer and an Indian Chief grasped, under the Calumet of Peace. Motto: "Peace and Friendship."

Three Coins of the United States, 1825.

A parchment Scroll on which was inscribed the following:

On the 8th day of June 1825 A. D. 5825 A L and of the independence of these United States the forty-ninth—this Corner Stone of the Hall of The Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts was laid in Ancient and Masonic Form by the Grand Lodge of Pennsylvania.

James Harper, Jr., R. W. G. M.

Thomas Kittera, R. W. D. G. M.

Samuel Badger, R. W. S. G. W.

Michael Nesbit, R. W. J. G. W.

Samuel H. Thomas, R. W. G. S.

Robert Toland, R. W. G. T.

The Franklin Institute was founded the 5th day of February, A. D. 1824, and incorporated the 30th day of March, 1824.

Names of the officers of the year 1825:

President, James Ronaldson.

Vice-presidents, Math. Carey, I. Lukens.

Recording Secretary, W. Strickland; Corresponding Secretary, P. A. Browne.

Treasurer, Thos. Fletcher.

Managers, Paul Beck, Jr., Jno. Harrison, Saml. R. Wood, William H. Keating, Jno. Haviland, Samuel V. Merrick, William Abbot, Jno. D. Eisenhut, Jno. P. Wetheril, James Clarke, Abm. Miller, Jas. Harper, Jr., Adam Ramage, Harvey Lewis, R. M. Patterson, James McAlpin, Wm. Fry, Wm. Kneass, Joseph Donaldson, J. B. Garrigues, Wm. S. Warder, Lloyd Miflin, A. G. Ralston.

Building Committee of the Hall:

Peter A. Browne, S. R. Wood, S. V. Merrick, James McAlpin, J. B. Garrigues.

Architect, Jno. Haviland.

M. Carpenter, Jas. Clarke.

M. Marble Mason, John Struthers.

M. Bricklayer, Daniel Groves.

The assembly was then addressed by P. A. Browne, Esq., and Adjourned.

(From the minutes of The Franklin Institute, Vol. A.)

Dr. Thomas P. Jones appointed Professor of Mechanics and Natural Philosophy.

October 6, 7 and 8, second exhibition of American manufactures held in Masonic Hall, Chestnut Street, west of Seventh. The number of articles exhibited far exceeded that of the previous year. Eighty-five premiums were offered. Six hundred and ninety-nine articles are listed in the catalogue of exhibits.

1826, January. First number of THE FRANKLIN JOURNAL was issued under the editorial management of Dr. Thomas P. Jones. In addition to his position as Editor, Doctor Jones also acted as Recording Secretary of the Institute and Curator of its collections. April 12, 1828, he was appointed Superintendent of the U. S. Patent Office.

It extended its educational efforts by establishing on April 6 a High School in which Mathematics, Drawing, Geography, History, Latin, Greek, French, Spanish and German were taught. Three hundred and four pupils were in attendance in October, 300 were studying English, 153 French, 105 Latin, 35 Greek, 45 Spanish, 20 German, 300 Elocution, 240 Geography, 231 Drawing, and all of them Mathematics. The School was continued until 1832 and was the predecessor of the Central High School.

October 3, 4, 5, 6, third exhibition of American manufactures was held in Masonic Hall. Silver medals were awarded for soft iron castings, flint glass ware, china from American materials, skirting and japanned leather, white lead, etc. Thirty-four thousand visitors.

1827. Select Committee on Dry Docks made a lengthy illustrated report on the plans submitted by Commodore James Barron, U. S. N., and Captain Thomas Caldwell, giving costs, methods of operation, etc.

October 4, 5, 6 and 8, fourth exhibition of American manufactures held in Masonic Hall. Sixty-two premiums were offered. John L. Wilson, a pupil of the High School of The Franklin Institute, was awarded a silver medal for his map of South America which was exhibited at that time.

1828, October 8, 9, 10 and 11, fifth annual exhibition of American manufactures held in Masonic Hall. Forty-five premiums were offered. Awards were made for specimens of annealed cast iron (the first attempt in this country to anneal iron for general purposes), for the best porcelain made in the United States, for calicos or prints, etc. Robert P. Warner, a pupil of the High School, was awarded a silver medal for his drawing of an air pump.

1829. Committee appointed to investigate the efficiency of moving water as a motive power. The report of the committee, containing much information, and the results obtained from seven hundred experiments, the effect of each of which was submitted to minute calculation, appeared in the JOURNAL

of the Institute for 1831 and 1832. The second portion of the report dealing chiefly with overshot wheels, undershot wheels, and breast wheels was published in March, April, May, June and July, 1841.

1830, September 14 to 19 inclusive, sixth exhibition of American manufactures held in Masonic Hall. The exhibition distinguished itself from all preceding ones by the great excellence of the articles deposited. Thirty-seven premiums were proposed, but three only were adjudged to be due; the first for the best stock or standing vice, the second for a cooking stove, and the third to the maker of a vegetable oil that would answer as a substitute for olive oil. The exhibit of American silk was most noteworthy.

Because of the numerous accidents in steamboats, a committee of five members was appointed to inquire and report whether it be expedient for the Board to institute an investigation into the probable causes of these accidents and the proper remedy to be applied to prevent their recurrence. The appointment of a large committee was suggested to inquire into the probable causes of the explosions of boilers, the best way to obviate the recurrence of these evils, and to limit the extent of their injurious influence. Seventeen members were appointed to undertake this investigation, including Dr. Thomas P. Jones, Prof. Walter R. Johnson, Matthias W. Baldwin, Frederick Graff and Isaiah Lukens. While the work of the committee was still in progress, the Secretary of the Treasury of the United States requested that further extension of the Institute's inquiry include the prevention of steam boiler explosions. This led naturally to an investigation of the strength of materials, and the committee devised apparatus of various forms for the testing of metals, building materials, steam boilers, etc. The correspondence and documents collected by the committee with its extensive report appeared in the issues of the *JOURNAL* of the Institute for 1831, 1832, 1833 and 1834. The report of experiments on the prevention of boiler explosions was published in January, February, March, April and May, 1836, and the results of the investigations on the strength of materials with numerous illustrations and detailed descriptions of original apparatus appeared in the *JOURNAL* February to August, 1837.

1831, October 4 to 8 inclusive, seventh exhibition of domestic manufactures held in Masonic Hall. Visitors exceeded forty thousand. Eighty-nine premiums were proposed of which fifteen were adjudged due. Fifteen additional premiums were recommended. A silver medal and one hundred dollars were awarded for a cast iron cooking stove for anthracite coal. Five hundred and forty-two articles were exhibited.

1832. Commenced an investigation into the resources of the Commonwealth considered in relation to its industry and manufactures, an occasion which led to a geological survey of the State.

Walter R. Johnson presented a notable communication on "The Strength of Cylindrical Steam Boilers." The results given are based on the extensive series of experiments made by the Institute's Committee on the Explosion of Steam Boilers.

1833. The Institute was requested by the State Legislature to examine and report upon a bill relating to weights and measures and admeasurement reported to the House of Representatives June 26, 1833. A special committee

of seventeen was appointed to consider the matter. The extensive report which included a detailed statement on the weights and measures of France, England and the United States, as well as an authentication of the Troy pound used in the United States Mint, appeared in the *JOURNAL* for November, 1833, and February to July inclusive, 1834. The Governor requested the committee to superintend the construction of the standards.

The present laws of the State are based on the recommendations made as a result of this investigation.

October 1 to 5 inclusive, eighth exhibition of domestic manufactures held in Masonic Hall. Over seven hundred exhibits. Fifty thousand visitors. Silver medals were awarded for lamps, pianos, rifles, hardware, carpets, cotton and woolen goods, etc.

1834. Joint committee of The Franklin Institute and the American Philosophical Society first began systematic meteorological observations in aid of agricultural and other interests. A circular issued by the committee requested observers to note the direction of the wind; to collect all information concerning storms—their width, direction, velocity, etc.; and the beginning and end of all rains. Detailed instructions were given for taking the "dew point." The committee consisted of eight members, three from the American Philosophical Society and five from The Franklin Institute, Dr. James P. Espy acting as Chairman. This committee continued its work successfully until 1838, when that portion appointed by the Philosophical Society were discharged by that body and the Board of Managers at once appointed a standing Committee on Meteorology to continue the collection of the data. By an Act of the Legislature, passed March 31, 1837, two thousand dollars were appropriated with the further sum of one thousand dollars for each of the two years next ensuing, for the purpose of promoting the improvement of meteorological science, and the furnishing of each county of this commonwealth with the necessary instruments for the observation of such atmospheric changes and phenomena as may be useful for the promotion of knowledge in the science of meteorology.

1835, October 7 to 10 inclusive, ninth exhibition of domestic manufactures held in Masonic Hall. Awards were made for samples of muslin, chintz prints, ginghams, venetian carpeting, straw bonnets, watch dials, water and oil colors, pearl work, leather, porcelain, etc.

1837. The general interest created by the Institute's work gave rise to a movement for the establishment of a school of arts, and a public lot for the erection of buildings was offered by City Councils on High (Market) Street, west of the Schuylkill River. An application for an appropriation from the State failed to pass the Legislature, and after further consideration by the Institute's Committee it was found inexpedient to organize any school at this time, and the plan was abandoned. The movement resulted later in the founding of the Department of Science of the University of Pennsylvania.

1838, November 6 to 17 inclusive, tenth exhibition of domestic manufactures held in Masonic Hall. The profits to the Institute on the present occasion were greater than was ever before realized, notwithstanding the heavy expenses incurred in making preparations. Awards were made for cotton and woolen goods, silks, straw goods, specimens of iron and steel, cutlery, philosophical

apparatus, harness, etc. A chandelier with thirty-eight lights made for the Senate Chamber of the State of Mississippi was one of the striking exhibits.

1839. The JOURNAL for November, 1839, contained a full translation by Prof. John F. Frazer of the paper "Practical Description of the Process Called the Daguerreotype, which Consists in the Spontaneous Reproduction of the Images of Natural Objects in the Camera Obscura, not with Their Colours, but with Great Delicacy in the Gradation of Tints" presented to the French Academy by Daguerre.

1840. A detailed review of Dr. Alexander Dallas Bache's report on education in Europe to the Trustees of Girard College for Orphans appeared in the JOURNAL for January (the report, covering nearly seven hundred pages, was made for use in connection with the organization of Girard College, of which Doctor Bache was President).

October 7 to 21 inclusive, eleventh exhibition of domestic manufactures held in Masonic Hall. Silver medals were awarded for cotton and woolen goods, specimens of iron and steel, hardware and cutlery, a cooking stove, a piano, wall paper, etc. Over one thousand exhibits.

October 18 to 31 inclusive, twelfth exhibition of American manufactures held in the Philadelphia Museum Building, northeast corner of Ninth and Sansom Streets and Welch's Olympic Circus, Walnut Street west of Eighth. No exhibition passed this in point of quality. About nine hundred exhibits.

1843. A request from City Councils for information on the best modes of paving highways. This question was referred to the Committee on Science and the Arts and a sub-committee of eight members were at once appointed. A voluminous report was presented, which gave careful consideration to all phases of the subject. The best construction of asphalt, wood and stone pavements was described. Pavements especially suitable to Philadelphia were noted, as well as plans and specifications, and superintendence and manner of executing the work. The report was accompanied by a map of Philadelphia showing the soils and drainage between the Delaware River and the Schuylkill River, and South Street on the south and Vine Street on the north.

October 17 to 28 inclusive, thirteenth exhibition of American manufactures held in the Philadelphia Museum Building. Silver medals were awarded for printed cotton goods, longcloths, gentlemen's boots and slippers, artificial teeth, etc.

1844, October 14 to 30, fourteenth exhibition of American manufactures held in the Philadelphia Museum Building. Fifty-nine silver medals were awarded for cotton and woolen goods, hardware and cutlery, glass ware, etc., and one hundred and fifty-four certificates of Honorable Mention.

1845, October 21 to November 1 inclusive, fifteenth exhibition of American manufactures held in the Philadelphia Museum Building. Fifty-one first-class premiums were recommended, two hundred and sixteen awards in all. Seventy thousand visitors.

1846, October 20 to 31 inclusive, sixteenth exhibition held in the Philadelphia Museum Building. Silver medals were awarded for gloves, specimens of rolled iron, lamps and gas fixtures, wire rope, coach harness, window shades, musical instruments, etc.

1847, October 19 to 30 inclusive, seventeenth exhibition of American manufactures held in the Philadelphia Museum Building. Silver medals were awarded for blankets, shawls, woolen and worsted yarn, bars of iron, the chandelier made for the Opera House at New York, machinery, glass ware, book binders' dies, chemicals, etc. Seventeen hundred and forty-two exhibits.

1848, October 17 to 28 inclusive, eighteenth exhibition of American manufactures held in the Philadelphia Museum Building. Silver medals were awarded for cotton and woolen goods, carpets, specimens of iron, lamps and gas fixtures, hardware, glass ware, furs, chemicals, etc. A first premium was awarded for a copy of the Webster dictionary, designed as a present to the Queen of England. Seventeen hundred and fifty-one exhibits.

1849, October 16 to 27 inclusive, nineteenth exhibition of American manufactures, held in the Philadelphia Museum Building. Silver medals were again awarded for products made from cotton and woolen materials, hardware and cutlery, also for Daguerreotypes, Talbottypes and Hyalotypes, boots and shoes, chemicals, needlework, etc.

1850. The School of Design for Women was founded by the Institute. Mrs. Sarah Worthington Peter, first Directress. Classes in art and design for women had been conducted by Mrs. Peter in her home, 327 South Third Street, for six years prior to the establishment of the school by the Institute.

In 1851 a room was leased at 70 Walnut Street (West of Third), where the School began as an independent institution under the direction of a special committee appointed by the Board of Managers of the Institute. This arrangement continued for two years when, in the spring of 1853, control was transferred to a separate organization, and Elliott Cresson, one of the Institute's benefactors, became the President.

October 15 to 26 inclusive, twentieth exhibition of American manufactures held in the Philadelphia Museum Building. Silver medals were awarded for tin ware, dental materials, chemicals, leather, saddlery and harness, philosophical instruments, etc. Nine hundred and fifty exhibits.

1851, October 21 to November 1, twenty-first exhibition of American manufactures held in the Philadelphia Museum Building. Awards were made for agricultural implements, carpetings, hardware, cabinet ware, lamps and gas fixtures, leather, chemicals, etc.

1852, October 19 to 30 inclusive, twenty-second exhibition of American manufactures held in the Philadelphia Museum Building. One special award, four gold medals, five recall first premiums (silver medals), eighty-six first premiums, fifty-two second premiums and thirty-eight third premiums were awarded. Ten exhibits were referred to the Committee on Science and the Arts. Twelve hundred exhibitors, one hundred thousand visitors. In number of exhibitors and articles displayed, as well as their beauty, novelty and value this exhibition was superior to any previous one held by the Institute.

1853, October 18 to November 3 inclusive, twenty-third exhibition of American manufactures held in the Philadelphia Museum Building. One hundred and eighty-six awards were made. Over eight hundred exhibits.

1854, November 14 to December 2, inclusive, twenty-fourth exhibition of American manufactures held in Dr. David Jayne's granite building on Dock

Street. Premiums were offered for perfumery and soaps, straw goods, chemicals, furs, saddlery and harness, leather, dental materials, surgical instruments.

1856, November 11 to 29 inclusive, twenty-fifth exhibition of American manufactures held in Doctor Jayne's building on Dock Street. Silver medals were awarded for specimens of rolled iron, hardware, stoves and heaters, cabinet ware, lamps and gas fixtures, silver ware and jewelry, cotton and woolen goods, chemicals, etc. Twelve hundred and twenty-six exhibits.

1858, October 15 to November 13, twenty-sixth annual exhibition of American manufactures held in the State Armory Building and adjacent grounds (Sixteenth and Filbert Streets). Awards were made for musical instruments, books, stationery, printers' type and materials, boots and shoes, needlework, coachwork, dental materials, philosophical apparatus, glass and china, lamps and gas fixtures, machinery, etc. A special pamphlet report on the sewing machines deposited at this exhibition was published in 1859.

1863. The Guardians of the Poor requested the Institute to communicate to them the most efficient means of protecting the Alms House Buildings from lightning.

A sub-committee of the Committee on Science and the Arts, to whom the problem was referred, made a survey of the grounds and buildings and recommended the installation of a system of lightning rods, properly connected and grounded. Detailed directions were given for making this installation.

At the Stated Meeting of the Institute held April 21, 1864, President William Sellers read a paper on a System of Screw Threads and Nuts. He pointed out the importance of a uniform system of screw threads, bolt-heads and nuts and offered suggestions for establishing such a system. Tables, diagrams and formulæ were submitted and comparisons were made with the English system. After a discussion it was voted to send copies of Mr. Seller's paper to other societies for consideration and approval. A special committee was appointed to investigate the question of a proper system of screw threads, bolt-heads and nuts, to be recommended by the Institute, for the general adoption by American engineers. The committee presented its report in December and recommended the adoption of certain forms and proportions. Copies of the report and resolutions were forwarded to the various departments of the United States Government and to the Superintendents and Master Mechanics of railroad companies requesting them to use their influence to promote the adoption of a uniform system of screw threads, bolt-heads, and nuts, by requiring all builders under any new contracts to conform to the proportions recommended. Copies were also sent to mechanical and engineering associations and institutions, machine and engine shops throughout the country with a request that they use their influence in favor of the proposed system. The Sellers or Franklin Institute system was adopted by the United States Government in 1868, in the following year the Pennsylvania Railroad Company ordered a set of gauges of the new form and adopted it and in 1872 the Master Car Builders' Association recommended the system as a standard.

1869. Organized the Expedition to observe the Solar Eclipse at Mount Pleasant, Iowa, on August seventh. A party of volunteers, twenty in number, under the direction of Henry Morton, attended to the various duties in connection with the observation. The telescopes were borrowed and the transportation

for the party and equipment was furnished by the railroad companies. The first account of the work of the members of this expedition appears in the *JOURNAL* of the Institute for September, 1869. (Vol. 88, p. 200.)

A committee of three was appointed to consider the subject of memorializing Congress in reference to an exposition of arts and manufactures on the centennial anniversary of American Independence, to be held in the city of Philadelphia. This action resulted in the appointment of a special committee of five to bring the matter to the attention of Select and Common Councils and request that they memorialize Congress on the subject. A joint committee was organized, consisting of nine members from each chamber of Councils, three members from each House of the Legislature, and five representatives of the Institute, for the purpose of obtaining such aid as would make such an exhibition truly international in its character.

The efforts of this committee resulted in the passage, by Congress, on March 3, 1871, of an Act to Provide for celebrating the 100th Anniversary of American Independence by holding an International Exhibition of Arts, Manufactures and Products of the Soil and Mine in the City of Philadelphia, and the State of Pennsylvania in the year 1876.

1871. The committee appointed June 21, 1871, to examine into the modes of determining the horse-power of steam boilers presented a preliminary report which appeared in the *JOURNAL* for August, 1871. The concluding report was published in August, 1872, and was fully discussed at the Stated Meeting of the Institute held in October, 1872 (J. F. I., December, 1872, Vol. 94, p. 377). It was voted to increase the membership of the Committee having charge of the experiments and have the investigation continued. A majority and minority report were presented to the Stated Meeting of the Institute on November 19, 1873, and appear in the *JOURNAL* for December, 1873. (Vol. 96, p. 396.)

1873. At the Stated Meeting of the Institute held February 19, 1873, the suggestions made by Prof. J. P. Lesley in a letter to the Governor of Pennsylvania dated February 1 (J. F. I., Vol. 95, p. 194) urging the establishment of a geological survey of the state were approved. In his letter Prof. Lesley called attention to the needs and advantages of a survey, the importance of accurate geological maps of the state and submitted suggestions for a complete working corps for the operations of the various departments of the survey. He estimated that the annual expense for personnel, laboratory, traveling expenses, instruments, publications and printing would be \$47,000.

On May 14, 1874, the Legislature passed a bill providing for a state survey, which was signed by the Governor on the same day. The bill included an appropriation of \$35,000 per year for three years. (This was the beginning of the Second Geological Survey of Pennsylvania.)

The April issue of the *JOURNAL* contains a report of the Committee on the Causes of Conflagrations and the Methods of their Prevention, with an exhaustive paper on "The Light Petroleum Oils; considered as to their safety or danger, in various domestic uses" prepared by Dr. William H. Wahl for the use of the committee.

At the Stated Meeting of the Institute held March 19, 1873, it was resolved to recommend and petition the Legislature to pass an act or acts embodying the following points: To appoint a competent commission to investigate and

determine some satisfactory test whereby it can be ascertained which oils or compounds are safe to be used in lamps and which are unsafe. To make it a penal offence to manufacture, compound, sell or knowingly use any oil or compound that will not stand the required test, and that in case of death resulting from the same, the guilty person or persons shall be liable to conviction for manslaughter.

1874, October 6 to November 12 inclusive, twenty-seventh exhibition of American manufacturers held in the Pennsylvania Railroad Station, Thirteenth and Market Streets, Philadelphia (site of the Wanamaker Store). Held to celebrate the fiftieth year of the founding of the Institute. Number of exhibitors—twelve hundred and fifty-one; paid admissions—two hundred and sixty-seven thousand six hundred and thirty-eight. Two hundred and one silver medals, two hundred and twenty-eight bronze medals and two hundred and twenty-two certificates of Honorable Mention were awarded.

1875. An ordinance passed by Councils June 5 requested the Mayor to appoint a commission of five scientific and practical engineers to be selected from not less than eight names recommended by the Board of Managers of The Franklin Institute, to whom in connection with the Chief Engineer of the Water Department, shall be referred the entire subject of the present and future water supply of Philadelphia. The Commission organized on June 29 and made a thorough investigation of the various pumping stations and reservoirs. Special examinations were made of the Wissahickon valley, the valley of the Perkiomen, the upper Schuylkill River and the Delaware River above tide, particularly at New Hope, Easton and the Water Gap. The report of the Commission was presented to Councils before the close of the year and contained nine recommendations for the improvement of the present water supply and special provisions for the centennial year. For future supply the Perkiomen reservoir and conduit seemed to be reasonably practicable. Abstracts of the Commission's report appear in the *JOURNAL* for November and December, 1875 (Vol. 100, pp. 292, 368).

In September the Board of Managers learned of the measures being taken to establish a Museum of Industrial Art similar to the South Kensington Museum, London, and gave the movement their endorsement. In December an invitation was extended to the Institute to choose one of the trustees of the Museum, and in January of the following year Mr. J. B. Knight, then Secretary of the Institute, was chosen to act in that capacity. For ten years the Institute had a voice in the management of the Museum.

1882. A resolution passed at the meeting of the Institute held May 7, requested the President to appoint a committee to give expression of the views of the Institute concerning the pollution of the waters of the Schuylkill River from the entrance of sewage near the eastern end of the Girard Avenue bridge. The report of the Committee appears in the issue of the *JOURNAL* for August, 1882 (Vol. 114, p. 135). Attention is called to the advantage which would arise to the general health of the city from the construction of an intercepting sewer along the eastern banks of the Schuylkill from Manayunk or beyond, and with an outlet sufficiently below the densely populated portions of the city as not to be objectionable.

In conformity with an ordinance passed June 7, the Mayor appointed a

Board of Experts consisting of one civil engineer, one mechanical engineer and one hydraulic engineer selected from nine names submitted by the American Society of Civil Engineers and the Institute, and the Chief Engineer of the Water Department to "report to Councils the methods pursued in the Water Department, together with their recommendations of what should be done for the present and future supply of the City, with such itemized estimates as will enable the cost to be determined." The preliminary report of this Commission was presented to Councils on October 14, 1882, and appeared in the *JOURNAL* of the Institute for April, 1883. It contained recommendations for the installation of machinery and apparatus in the several pumping stations, the completion and extension of reservoirs and the management of the stations. The final report was transmitted to Councils on April 5, 1883 (*J. F. I.*, Vol. 116, p. 321). Special attention was given to the future supply of the city and the reduction of waste. The use of meters for factories and large public buildings was suggested.

A paper on the Prevention of Fires in Theatres was read at the Stated Meeting held June 21 by Charles J. Hexamer, C. E., (*J. F. I.*, Vol. 114, pp. 125, 211). At the close of the discussion which followed the reading of the paper, it was voted to appoint a committee to investigate the subject of the prevention of fires in theatres. The report of this committee was presented to the Stated Meeting of the Institute on April 18, 1883, and printed in the *JOURNAL* for June (Vol. 115, p. 428). It contains much information on theatre fires, the hazards of artificial light, heating apparatus, fireworks, the use of paper wads in guns, the situation of the necessary work shops, paint lofts and spontaneous combustion. Considerable attention is given to the fire-proof drop curtain, and after having obtained information from many sources the committee expressed the opinion that woven asbestos cloth is most satisfactory. The report contains thirty-eight recommendations intended to make places of amusement more safe, nearly all of which have since been adopted.

1884, September 2 to October 11. The International Electrical Exhibition, held in the Pennsylvania Railroad Station at 32nd and Market Streets and a building especially erected at the northwest corner of 32nd Street and Lancaster Avenue.

Without federal or state aid the Institute held the first great electrical exhibition in this country. Total number of paid admissions, 282,779; receipts from sale of tickets, \$98,639.70. Two hundred and sixteen exhibitors.

By an act of congress the United States Electrical Commission was created for the purpose of conducting a national conference of electricians. This commission issued invitations to a large number of scientific gentlemen, both foreign and American, who assembled in conference on September 8 and continued their deliberations for six days.

During and immediately after the exhibition the most complete and extended series of tests attempted to that time were made to determine the characteristics of all the more important types of electrical apparatus and appliances then commercially used. The results of these tests were published in the *JOURNAL* and in pamphlet form during 1885 and 1886 as the Reports of the Examiners.

The organization of the American Institute of Electrical Engineers this year resulted from the holding of the electrical exhibition and the international conference of electricians.

1885, September 15 to October 31. The Novelties Exhibition held in the buildings erected for the use of the electrical exhibition; this was the twenty-ninth exhibition and was devoted to novelties in American manufactures. Three hundred and seventy-five exhibitors.

Awards of medals and diplomas were made for articles of novel or intrinsic merit.

1886. At the Stated Meeting of the Institute held October 20, 1886, it was resolved that the subject of organizing a State Weather Service be referred to a special committee, to be appointed by the President, with the request to report a plan for the same, if possible, to the Stated Meeting of the Institute in November.

On December 15 the special committee presented its report and recommended immediate organization of a "State Weather Service" with a volunteer force of observers; that the coöperation of railroad, telegraph and telephone companies and newspapers be solicited; that all institutions of learning throughout the state be invited to take an active interest in the collection of meteorological data and the study of the science; that an effort be made to secure an appropriation of \$3000 from the state, for the purchase of instruments and for the publication of the results of observations in tabulated form.

The offer of the Chief Signal Officer to furnish a member of the Signal Corps to assist in the work was accepted.

An Act to establish a State Weather Service was at once drafted and passed by the Legislature and the first Summary of Meteorological Reports giving the results of observations made in September appeared in October, 1887.

The service was in operation until May, 1891, when the State discontinued the appropriation.

1889. President Joseph M. Wilson, at the Stated Meeting of the Institute held November 20, made some remarks upon his observations of trade schools in France and England, having been charged with the task of investigating the organization and mode of operation of such institutions on behalf of the projected school of Mr. A. J. Drexel, of Philadelphia.

Mr. Wilson's complete report "On Schools: with particular reference to Trade Schools," appeared in the issues of the JOURNAL February to October inclusive, 1890.

1897. The Board of Health of the City of Philadelphia requested the appointment, by The Franklin Institute, of a committee to coöperate with the Board, in considering ways and means for the abatement of the growing evils arising from the increasing use of bituminous coal within the city limits.

At the meeting of the Institute of April 21, 1897, the regular order of business was suspended and the evening was devoted to the consideration of "The Smoke Nuisance and its Regulation." The discussion was introduced by a paper giving a brief historical account of the subject and some data having especial reference to the smoke question as it affects Philadelphia.

The discussion was continued by brief addresses from eleven prominent engineers and the president of the Board of Health.

The discussion was resumed at the meeting of May 19 by ten engineers of note and the president of the Board of Health.

It was the unanimous opinion of those present at the meeting of September 15, that the frequent discharge of dense black smoke from furnaces of stationary boilers is avoidable and should not be permitted in the city and that the emission of smoke from locomotives and furnaces might be greatly reduced if the coöperation of firemen and employers were enlisted with an earnest intention to abate the nuisance. Resolutions to this effect were approved and it was directed that copies be sent to the Mayor, the president of the Board of Health and to the president of Councils. At this meeting descriptions were presented of improved furnaces and automatic stokers. The representatives of five of the leading manufacturers were present and described their apparatus illustrating their remarks with the aid of models and lantern slides.

The discussion was concluded at the meeting of October 20 when ten stokers and furnaces were described.

A detailed account of the above discussion appeared in the issues of the JOURNAL for June, July and December, 1897, and January and February, 1898.

1899. National Expert Exposition held in conjunction with the Commercial Museum of Philadelphia.

The seventy-fifth anniversary of the founding of the Institute was observed by a series of conferences and lectures held in the Convention Hall of the exposition on October 2 to 7 inclusive.

1901. A special committee appointed by the President to consider the advisability and feasibility of the adoption of the metric system in the United States, presented its report on February 19, 1902.

The following preambles and resolutions submitted by the Committee were unanimously adopted:

WHEREAS, It is desirable to obtain an international standard of weights and measures, also to simplify and regulate some of our existing standards; and

WHEREAS, The metric system is commendable, not only as a suitable international standard, but also for facility of computation, convenience in memorizing and simplicity of enumeration;

Resolved, That The Franklin Institute approves of any movement which will promote the universal introduction of the metric system with the least confusion and expense.

Resolved, That the National Government should enact such laws as will ensure the adoption of the metric system of weights and measures as the sole standard in its various departments as rapidly as may be consistent with the public service.

The report, discussion and important correspondence on the subject were published in the JOURNAL for June, July and August, 1902.

In order to promote both domestic and foreign commerce, the following preambles and resolutions were adopted at the Stated Meeting of the Institute held on December 18.

WHEREAS, Greater and cheaper transportation facilities are essential to the development of our domestic and foreign commerce;

WHEREAS, The limited appropriations made by the National Government are inadequate to meet the requirements of the country, covering only a small percentage of the approved projects;

WHEREAS, The former policy of authorizing the improvement of our waterways by private capital resulted in a marked development without material cost or risk to the general Government;

WHEREAS, Early and economical results may be secured by a partial return to this method in localities where no provision has been made for immediate improvement; therefore, be it

Resolved, That the proper department of the general Government should be empowered to authorize the improvement, by individuals or corporations, of such rivers, harbors, canals or other waterways as are not provided for under the River and Harbor or the "Sundry Civil" Bills, with authority to collect tolls, upon plans and regulations to be approved by the said department; PROVIDED, that no part of the funds for such work shall be drawn from the public treasury of the United States. Also,

WHEREAS, The commercial and industrial interests of the country have attained such magnitude as to require a more systematic organization for their regulation and development;

WHEREAS, A measure known as Senate Bill No. 738 has been introduced into Congress for the purpose of establishing a Department of Commerce and Industries; therefore, be it

Resolved, That the establishment of such a Department of Commerce and Industries has the hearty approval of The Franklin Institute, and its early inauguration is recommended.

1906. At the Stated Meeting of the Institute, held September 19, at the conclusion of the reading of a paper on "The Relations of the Government to Our Waterways" by Prof. Lewis M. Haupt, the following preamble and resolutions were unanimously adopted:

WHEREAS, It is the present established policy of the general Government to provide ample facilities for the water-borne commerce of the United States and to emancipate interstate commerce from the obstructions imposed by tolls or restricted canals under private or corporate control, and

WHEREAS, This policy has been successfully inaugurated in all parts of the country with the exception of the early canals skirting the most populous and important cities of the Atlantic seaboard, and

WHEREAS, The best interests of the country demand the early construction of capacious canals connecting the interior waters of the bays and sounds of this coast, for commercial purposes as well as for national defense, and

WHEREAS, The most important and least expensive of these links is the one connecting the waters of the Chesapeake and Delaware Bays by a canal which is less than fourteen miles in length, and which has a trunk of only nine feet in depth and sixty-six minimum width, in which the Government is a joint owner, and concerning which its officials and commissions have

invariably reported that it is vital for the protection of the coast, as has been demonstrated in our several wars, and

WHEREAS, Congress has again authorized the appointment of a Commission to ascertain the expense of securing control of the works and franchises of the Chesapeake and Delaware Canal with a view to the acquisition of the aforesaid canal as a free and open waterway, which Commission is to report at the coming session of Congress.

Be it therefore *Resolved*, That The Franklin Institute of Pennsylvania reaffirms its position as to the urgent necessity of enlarging our coastwise waterways, and especially the Chesapeake and Delaware Canal for commercial and strategic purposes at the earliest practicable date.

Resolved, That a committee be appointed to present this resolution to the Commission at the public hearing to be held in this city on the 27th instant.

1912. Centenary of the Introduction of Gas as an Illuminant observed on April 18 and 19.

The Institute with the coöperation of the American Philosophical Society, the American Chemical Society and the American Gas Institute arranged a series of meetings and lectures dealing with subjects relating to gas and gas manufacture. An important feature of the celebration was a loan exhibition of models, photographs, sketches, prints, manuscripts and drawings relating to every phase of the gas industry; also specimens of gas meters, lamps and burners, gas stoves and other appliances.

1914. Conducted meeting in Philadelphia on June 3 in commemoration of the thirtieth anniversary of the International Electrical Exhibition. Addresses were made by Messrs. E. W. Rice, Charles F. Brush and Frank J. Sprague.

1915. First awards of The Franklin Medal.

1916. Format of the JOURNAL changed from 6 x 9 inches to 6½ x 9½ inches with increase in the number of reading pages.

1917. Established and maintained a recruiting and examination station for applicants for admission to the Aviation Service of the United States Army. Established School of Navigation for the United States Shipping Board. Conducted free Radio School for men of the selective draft.

1920. Published "Physics of the Air," by W. J. Humphreys, C.E., Ph.D., 665 pages, illustrations, diagrams, octavo.

1921. Received \$1,208,468.32 from the bequest of Henry W. Bartol, a life member of the Institute, for research. "Bartol Research Foundation," established for the purpose of conducting researches relating to fundamental problems in physical science, particularly those in the field of electricity, and for the investigation of specific problems of a scientific nature which may arise in the industries.

1922, March 6 to 10 inclusive. F. W. Aston, M.A., D.Sc., F.R.S., Fellow of Trinity College, Cambridge, England, delivered a course of lectures on "Atomic Weights and Isotopes."

1923, April 9 to 13 inclusive. Sir Joseph John Thomson, O.M., F.R.S., LL.D., Ph.D., D.Sc., Master of Trinity College, Cambridge, England, delivered a series of lectures on "The Electron in Chemistry." Subsequently published in book form, 144 pages, octavo.

1923. Laboratory for conducting the work of the Bartol Research Foundation, provided for by the reconditioning of three buildings on the Institute's property, at Nineteenth and Cherry Streets.

1924, September 17, 18, 19. The centennial anniversary of the founding of The Franklin Institute in 1824 was celebrated by noteworthy exercises extending over three days, and at the same time exercises inaugurating the activities of the Bartol Research Foundation were held. These exercises consisted of formal conferences of a scientific nature, lectures by distinguished scientists, receptions, and the formal opening of the Bartol Research Laboratories, and were terminated by a great dinner given to the delegates and members of the Institute.

The delegates were received formally on the first day of the celebration. Lectures by forty-six world-renowned scientists and inventors were delivered during the three days. The hospitable citizens of Philadelphia entertained the delegates and visitors by luncheons, dinners, and lawn fêtes. Appropriate exercises were held at the Bartol Laboratories to signalize the completion of the preparations for active work under the Foundation.

The final centenary dinner brought together what was probably the most distinguished gathering of scientists from all the world ever collected in America. Greetings and congratulations, both formal and informal, were presented from all the institutions and societies represented. Speeches were made by at least one representative of every foreign country from which a delegate was present, and by representatives of the University of Pennsylvania and Princeton University. All expressed congratulations to the Institute for its honorable history and its long record of usefulness and all uttered confident good wishes for continued growth and success.

The lectures delivered during the Centenary Celebration were subsequently published by the Institute in the form of monographs.

1925, October 1. The first Bartol Research Foundation Fellow was appointed and active research work at the Laboratories was inaugurated.

CHARTER AND BY-LAWS

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS

An Act, to incorporate The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts.

SECTION 1. Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania in General Assembly met, and it is hereby enacted by the authority of the same, That the subscribers to the association called The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, and all such persons as may hereafter be admitted members of the same, shall be, and they are hereby declared to be, a body politic and corporate, by the name and style of "THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS," to have perpetual succession, to sue and be sued, implead and be impleaded, in all courts of record or elsewhere, to use a common seal, and break, alter, and renew the same at pleasure, and to take, hold, and enjoy lands, tenements, and hereditaments; Provided that the yearly income of the real estates held by them shall not exceed two thousand dollars.

SEC. 2. And be it further enacted by the authority aforesaid, That the objects of the said corporation shall be the promotion and encouragement of manufactures and the mechanic and useful arts, by the establishment of popular lectures on the sciences connected with them, by the formation of a cabinet of models and minerals, and a library, by offering premiums on all objects deemed worthy of encouragement, by examining all new inventions submitted to them, and by such other measures as they may judge expedient.

SEC. 3. And be it further enacted by the authority aforesaid, That the members of the said corporation shall consist of manufacturers, mechanics, artisans, and persons friendly to the mechanic arts; they shall pay such sum annually, or in gross, as shall be required by the by-laws of the said corporation for an annual, or life, subscription; Provided that nothing herein contained shall be construed to prevent the said corporation from electing honorary or corresponding members, who may be exempted from such payments and other duties of membership, in such manner and to such extent as may be prescribed by the by-laws of the said corporation.

SEC. 4. And be it further enacted by the authority aforesaid, That the officers of the said corporation shall be a president, two vice-presidents, a recording secretary, a corresponding secretary, a treasurer, and twenty-four managers, who shall, together, constitute a board of managers of the said corporation, and such other officers as the said corporation shall deem needful; two-thirds of the managers shall be manufacturers or mechanics; the said

officers shall be elected at an annual meeting of the said corporation, to be held on the third Thursday of January; if an election shall not take place on that day, the corporation shall not for that cause be dissolved, but an election shall be held as soon afterwards as may be, and until such election the officers in place shall continue to act; public notice of all elections shall be given in such manner as may be prescribed by the by-laws of the said corporation; the present officers of the said association are hereby constituted the officers of the corporation hereby created and shall continue to hold their respective offices till otherwise elected under the provisions of this act; Provided always, that the said corporation shall have power to increase the number of vice-presidents and managers hereinbefore mentioned, to such number as may be deemed advisable and convenient at a stated meeting of the said corporation, the same public notice of such intended alteration being previously given as may be required to be given of the election of officers of the said corporation.

SEC. 5. And be it further enacted by the authority aforesaid, That the duties and rights of the members of the said corporation, the powers and functions of the members of the said corporation, the powers and functions of the officers thereof hereinbefore mentioned, and of such others as may hereafter be added, the mode of supplying vacancies in office, the times of meeting of the said corporation, and of the board of managers, the numbers which shall constitute a quorum at any such meetings, the mode of electing members, the terms of their admission, the causes which shall justify their suspension or expulsion from the corporation, and all other concerns of the said corporation shall be regulated by the by-laws and ordinances of the said corporation hereafter to be made, which the said corporation is hereby authorized and empowered to make and alter, in the manner which may be therein mentioned; Provided that the said by-laws or ordinances shall not be repugnant to, or inconsistent with, the constitution or laws of the United States or of this Commonwealth.

OFFICE OF THE CLERK OF THE SENATE OF THE COMMONWEALTH OF
PENNSYLVANIA,

March 30th, 1824.

I certify that the foregoing Bill passed both branches of the Legislature, and received the signature of the Governor on this day. As witness my hand the day and year above written.

(Signed.)

JNO. DUPUY, *Clerk.*

An Act to amend and alter the Act incorporating The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts.

WHEREAS, The Act approved March thirtieth, one thousand eight hundred and twenty-four, incorporating The Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, has been found insufficient and inconvenient for accomplishing the objects of said corporation, and the said corporation has applied for alteration and amendment thereof.

SECTION 1. Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania, in General Assembly met, and it is

hereby enacted by the authority of the same, that the present members of said corporation, and all such persons as may hereafter become members thereof, shall be, and are hereby created, a body politic and corporate by the name of "THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS," and shall have perpetual succession, be able to sue and be sued, to plead and be impleaded, to have and use a common seal, and the same to break, alter and renew at pleasure, and shall be able to take, hold, purchase and enjoy such real and other estates of any nature or kind whatsoever as they may obtain by purchase, devise, bequest or gift, and the same at their pleasure to sell, lease, mortgage, pledge, encumber, or dispose of as they may deem proper or convenient for promoting the objects of the said corporation; and the said corporation shall have the like power over any real estate or other estates now owned or held by them; *provided*, that the clear yearly value of the real estate at any time held by them shall not exceed ten thousand dollars.

SEC. 2. That it shall be lawful for the said corporation to raise funds for the payment of its present indebtedness, and for all other purposes of the said corporation, to create and sell such number of shares of stock, at ten dollars each, as may be deemed proper to represent the estates of the said corporation, and the certificates of such stock shall be in such form, be transferable in such manner, subject to such payments, and entitle the holder thereof to such privileges, as the said corporation may, by its By-Laws in reference to such stock, grant and direct.

SEC. 3. The object of the said corporation shall be the promotion and encouragement of manufactures and the mechanical and useful arts, by the establishment of lectures on the sciences connected with them, by the formation of cabinets of models, minerals, machines, materials and products, by exhibitions and premiums, by a library and by all such measures as they may judge expedient.

SEC. 4. The members of the said corporation shall consist of manufacturers, mechanics, artisans, and persons friendly to the mechanic arts, and of such stockholders in said corporation as may, by the By-Laws, be entitled to the privileges of members; and every member shall pay such sum for an annual or life subscription as the By-Laws of said corporation may require; and honorary and corresponding members may be elected at such times, and in such a way, and with such privileges as said corporation may deem expedient.

SEC. 5. The said corporation shall be managed in such way, and by such number of officers, managers and other persons as the By-Laws may prescribe, and the powers and functions of such officers, managers or other persons, the rights and duties of members, the manner of their election, and the causes which may justify their expulsion or suspension, and all other concerns of the said corporation, shall be fixed and regulated by its By-Laws, which By-Laws shall be adopted by said corporation at the first monthly meeting after the acceptance of this amended Charter, and said By-Laws shall be altered and amended only in the manner provided in said By-Laws as then adopted.

SEC. 6. So much of the Act to which this is a supplement as is inconsistent herewith is repealed.

OFFICE OF THE SECRETARY OF THE COMMONWEALTH OF PENNSYLVANIA,

April 25th, 1864.

I certify that the foregoing bill passed both branches of the Legislature, and received the signature of the Governor on this day. As witness my hand the day and the year above written.

(Signed.)

ELI SLIFER, *Secretary of the Commonwealth.*

BY-LAWS OF THE INSTITUTE

ARTICLE I.—*Stock*

SECTION 1. The Real and Personal Estates of the Institute as held upon the First day of January, One Thousand Eight Hundred and Eighty-one, shall be valued at One Hundred Thousand Dollars, and shall be represented by Ten Thousand Shares of Stock of the par value of Ten Dollars each. Said shares shall be divided into two classes, *viz.*:—

First Class.—Shares not registered for use: on which no annual payment shall be charged or collected, and the holders thereof shall not have the privileges of members of the Institute, but may, if of legal age, vote at any annual election for officers and managers upon the payment of One Dollar upon each share of stock on which they may desire to vote; provided, however, such shares have been held by the same person at least three months before such election.

Shares of the First Class may be converted into shares of the Second Class at the pleasure of the owners, provided the transfer be approved by the Board of Managers; but, when once so converted, they shall always continue in the Second Class.

Second Class.—Shares registered for use: on which Twelve Dollars per annum shall be due and payable from resident members in advance on the first day of October in each year, except as hereinafter provided.

Non-resident holders of Second Class stock shall pay an annual fee of Five Dollars.

SEC. 2. The holders of Second Class stock shall be entitled to the use of the library, lectures and reading-room; and, if of legal age, to all other privileges of membership in the Institute, so long as they make the annual payment in advance; and shall, on the payment of One Dollar therefore, be entitled to a Certificate of Membership.

SEC. 3. If the annual dues for successive years remain unpaid at the expiration of two and a half years on any share of stock of the Second Class, such share shall then become forfeited to the Institute; but such forfeiture may be remitted by a unanimous vote of the Board of Managers.

SEC. 4. Stock of the Second Class may be held in trust for persons not of legal age, and shall be liable to the payment of only one-half the annual fees due upon stock of Second Class held by persons of legal age; provided, that when such minors arrive at legal age, new certificates, subject to the full annual contribution, shall issue on payment of the customary fee.

SEC. 5. Certificates for the First Class stock may be issued for any number of shares in a single certificate; but every certificate for the Second Class shall be for one share only.

SEC. 6. No share of stock in the Second Class shall be transferred until all arrearages and fines are paid, and all books and tickets returned, and the transfer approved by the Board of Managers.

SEC. 7. All certificates of stock shall be signed by the President and Secretary; shall be issued by the Controller, and shall be transferable only on the books of the Institute by the owner, or his legal representative, on the surrender of the old certificate, and of a fee of twenty-five cents for each certificate.

SEC. 8. All subscriptions to stock shall be approved by the Board of Managers before the certificate can be issued.

ARTICLE II.—*Members*

SECTION 1. Members of the Institute shall consist of those engaged or interested in scientific pursuits or in the application of science in the mechanic and industrial arts. All persons interested in the purposes and activities of the Institute, and who are willing to further them, may become members when proposed by members in good standing and elected by the Board of Managers. The membership of the Institute shall consist of the following classes of members, *viz.*, Honorary and Corresponding, Endowment, Life, Contributing, Resident, Non-resident, Student, and holders of Second-class Stock.

SEC. 2. Honorary and Corresponding members shall be nominated by the Board of Managers and shall require for their election four-fifths of the votes of the members present at any stated meeting of the Institute at which their nomination may be acted upon. They shall not be entitled to vote nor to hold office. All other members shall be elected by the Board of Managers.

SEC. 3. Endowment members shall consist of persons, firms, corporations or associations who shall make an endowment payment of Five Thousand Dollars (\$5000) to the Institute, and who, upon acceptance thereof by the Board of Managers, shall thereafter have the privilege of nominating annually to the Board of Managers for election (subject to its discretion as to any particular nominee) as Resident members of the Institute for its then current year without payment of dues that number of persons, to be determined from time to time by the Board of Managers, whose annual dues if they were paying annual Resident Membership dues would approximately equal but not exceed the then current income from such endowment payments. Such Endowment Memberships shall be perpetual, and shall be transferable by the holders thereof by will or otherwise: Provided, however, that the Board of Managers at any time may refund Five Thousand Dollars (\$5000) to the then holders of any such membership, and annul and terminate that membership.

SEC. 4. Contributing members shall consist of firms, corporations, associations or individuals who shall pay annually the sum of Three Hundred Dollars (\$300). A Contributing member shall have the right to nominate nineteen persons to the Board of Managers for election as Resident members for the year then current, subject to the discretion of the Board as to any particular nominee, and members thus elected shall pay no dues.

SEC. 5. Resident Life members, whose memberships shall not be transferable, are those members who shall pay the sum of Three Hundred Dollars (\$300) in any one year. Non-resident Life members shall be those who reside

permanently at a distance of not less than twenty-five miles from Philadelphia and who shall pay the sum of One Hundred Dollars (\$100) in any one year.

SEC. 6. Resident members shall be residents of the City of Philadelphia who have been elected to membership in the Institute and who shall pay annual dues of Fifteen Dollars.

SEC. 7. Non-resident members shall be those members who reside permanently at a distance of not less than twenty-five miles from Philadelphia and who shall pay annual dues of Five Dollars. They shall also pay an initiation fee of Five Dollars.

SEC. 8. Student members shall be over sixteen and under twenty-two years of age. They shall pay annual dues of Three Dollars if they do not receive the JOURNAL of the Institute, and Six Dollars if they do receive the JOURNAL. The term of student members shall be limited by the age of twenty-two years, after which time they shall be eligible for transfer to the other classes of membership upon the payment of the appropriate fee or dues.

SEC. 9. Privileges: All members, of whatever class, are entitled to participate in the meetings of the Institute, in the use of the Library, to receive tickets for the lectures, and to receive monthly one copy of the JOURNAL of the Institute, except that student members, and honorary and corresponding members shall not have the right to vote, nor to hold office, and student members paying the Three-dollar annual dues shall not receive the JOURNAL of the Institute.

ARTICLE III.—*Payments of Dues*

SECTION 1. The annual fees for membership shall be due and payable on the first of October in each year, in advance, but all members elected after the thirty-first of March in each year shall pay in advance for the current year one-half of the annual dues.

SEC. 2. Any member whose dues are more than three months in arrears shall be notified by the Controller. Should such dues not be paid when they become six months in arrears, the privileges of membership shall be suspended. When nine months in arrears such member shall be notified again, and if such dues become one year in arrears, the said member shall forfeit all connection with the Institute. The Board of Managers at its discretion may extend the time for payment and for the application of these penalties.

The Board of Managers may remit temporarily the annual dues of any member who, for reasons satisfactory to the Board, is unable to pay such dues; and the Board may remit the whole or part of the dues in arrears or accept in lieu thereof service or material contributed to the Institute.

SEC. 3. Every person admitted to membership in the Institute shall be considered as liable for the payment of dues until he shall have resigned, been dropped or have been relieved therefrom by the Board of Managers.

SEC. 4. Resignations of membership shall be made to the Board of Managers in writing, but need not be accepted until all dues and arrears up to date of resignation shall have been paid.

SEC. 5. The annual dues from members may be applied to the current expenses of the Institute, but all moneys received from Life and Endowment

memberships shall be added to the capital account of the Institute, and only the income therefrom shall be applied to current expenses.

ARTICLE IV.—*Election of Officers*

SECTION 1. The officers shall be a President, three Vice-presidents, a Secretary, a Treasurer, a Controller, a Librarian, and twenty-four Managers.

SEC. 2. At the annual meeting of the Institute the President and the Treasurer shall be elected to serve one year, and one Vice-president, and eight Managers, shall be elected to serve for three years; provided, that the officers now elected or who may hereafter be elected shall continue to serve until their successors be elected.

SEC. 3. All elections for officers of the Institute shall be by letter ballot, and no vote may be cast by proxy.

SEC. 4. Nominations for President, Vice-president, Treasurer and Managers shall be made in writing at the stated meeting in the month of December. Each nomination paper must be signed by at least two members, who shall certify that the candidate will serve if elected. After the nominations are closed, the President shall appoint three members, who are neither officers nor nominees, to act as tellers of the election. The list of nominees shall be posted at the Institute and incorporated (with directions for voting) in a ballot to be sent to each member by the Secretary at least one week before the date of the election. Each ballot shall be accompanied by a return envelope addressed "To the Tellers of Election," and provided with a space for the signature of the member voting.

SEC. 5. On the date of the annual meeting, and at an hour previously designated by their chairman, the tellers shall meet at the Institute and shall count all legal votes that have been received by mail or placed in the ballot box before 8 o'clock P.M.; and when the count is completed they shall report to the annual meeting of the Institute the total number of ballots cast, together with the number of votes received by each candidate. Thereupon the presiding officer shall announce the names of the candidates who received the plurality of votes for each office, and shall declare them elected officers of the Institute for the ensuing terms.

ARTICLE V.—*Duties of Officers*

SECTION 1. The President shall be the executive head of the Institute and as such shall have the general direction and supervision of all the affairs of the Institute. He shall preside at all meetings of the Institute and of the Board of Managers and shall be *ex officio* a member of all committees of the Institute and of the Board.

SEC. 2. The Vice-presidents shall exercise the duties of the President in his absence in the order of their seniority in office.

SEC. 3. The Secretary of the Institute shall be appointed by the Board of Managers and shall have charge and supervision, subject to the Board of Managers, of all the scientific activities of the Institute, other than those connected with the Bartol Research Foundation, its publications, museum and equipment. He shall keep the minutes of all meetings of the Institute and

of the Board of Managers, and shall perform all the duties usually pertaining to the office of Secretary. He shall be *ex officio* a member of the Board of Managers, and of all standing committees of the Institute and of the Committee on Publications of the Board of Managers.

SEC. 4. The Treasurer shall receive all funds, payable to the Board of Managers, and all moneys collected for the Institute. He shall deposit all moneys received, in the name of the Institute, in such banks or trust companies as the Board of Managers may direct. He shall make no payments without the authority of the Board of Managers. He shall see that there are kept accurate accounts of the income and disbursements of the Institute, shall report current receipts and payments at each stated meeting of the Board of Managers, and shall make a detailed statement of the financial condition of the Institute as its annual meeting. He shall give bond to an amount, and with such surety, as the Board of Managers shall determine. In case of a vacancy in the office of Treasurer, it shall be the duty of the Board of Managers to appoint a person to perform the duties of the position until the next annual meeting.

SEC. 5. The Board of Managers shall appoint the Controller, who shall keep all the accounts of the Institute, shall collect all moneys due the Institute and deposit them in the Treasurer's account, and shall approve all expenditures. He shall act with the Committee on Finance in the preparation of the annual budget. He shall act as the business agent of the publications of the Institute. He shall have charge of the buildings of the Institute and shall be responsible for their maintenance, repairs and insurance. He shall perform such other duties as may be prescribed by the Board of Managers.

SEC. 6. The Board of Managers shall appoint a Librarian, who shall have charge of the library and reading-room of the Institute, and who shall perform the duties usually pertaining to such office, subject to instructions from the Board.

ARTICLE VI.—Board of Managers

SECTION 1. The Board of Managers shall have entire charge and control of the affairs of the Institute, and shall consist of twenty-four members elected as provided in Article IV. The President, the Vice-presidents, the Secretary, the Treasurer, and the Chairman of the Committee on Science and the Arts shall be *ex officio* members.

SEC. 2. They shall present, through the President, at the annual meeting of the Institute, a report of their proceedings and of the condition of the affairs of the Institute.

SEC. 3. They shall hold stated meetings once in each month except in July and August. The chairman shall be the President of the Institute. Seven of their members shall constitute a quorum.

SEC. 4. Special meetings may be called by the President at his discretion, and shall be called by him on written request of the Executive Committee or of any seven members of the Board. In case of his absence or refusal to act, any special meeting shall be called by the Secretary.

SEC. 5. Members who have not attended five regular meetings in the twelve months prior to the stated meeting of the Institute in December, shall be

reported thereat as having resigned, unless it be unanimously voted by the Board at that meeting, that such member has been absent for sufficient reason.

SEC. 6. All vacancies on the Board of Managers shall be filled by the Board until the next annual meeting of the Institute.

ARTICLE VII.—*Committees of the Board of Managers*

The following standing committees of the Board of Managers, each consisting of five members, shall be appointed by the President and approved by the Board:

1. Executive.
2. On Endowment.
3. On Finance.
4. On Membership.
5. On Publications.
6. On Bartol Research Foundation.

The Executive Committee shall make to the Board such recommendation as it may deem advisable, but in the absence of specific delegation of authority, it shall have no power to act on behalf of the Board.

The Committee on Finance shall have charge of all securities and investment funds belonging to the Institute and shall invest and reinvest the same and pay the income therefrom to the Treasurer of the Institute. The Committee may, with the approval of the Board of Managers, appoint a trust company of the City of Philadelphia to act as fiscal agent under the direction of the Committee. All purchases or sales of securities shall be reported monthly to the Board.

The Bartol Research Foundation Committee shall have charge of the provision, maintenance and operation of all laboratories and equipment concerning the Bartol Research Foundation. It shall engage the professional staff subject to the approval of the Board of Managers of the Institute and shall also engage and direct the operators and helpers employed in the work of the Foundation. It shall be composed of not more than twelve members, as follows: Five members of the Board of Managers, appointed by the President and approved by the Board; the President; the Director of the Bartol Research Laboratories; five members appointed by the President with the approval of the Board from the membership of the Institute not members of the Board.

The Director of the Bartol Research Laboratories shall report to the Bartol Research Foundation Committee. All other employees of the Foundation shall report to the Director. The Committee shall have full power to carry out the purposes of the Foundation. It shall make a report of its operation to the Board of Managers at each stated meeting.

ARTICLE VIII.—*Audits*

The accounts of the Treasurer and of the Fiscal Agent shall be audited at least once a year by certified public accountants, who shall report to the Board of Managers.

ARTICLE IX.—*Committees of the Institute*

SECTION 1. There shall be the following standing committees of the Institute:

1. On Library.
2. On Meetings.
3. On Museum.
4. On Science and the Arts.

SEC. 2. The Committees on Library, Meetings and Museum shall consist of ten members each, appointed by the President at the first stated meeting after the annual election, to serve one year.

SEC. 3. The Committee on Library shall purchase books and other publications of a kind and character suitable to and consonant with the purpose of the Institute's library.

SEC. 4. The Committee on Meetings shall act with the Secretary of the Institute to secure for presentation before the Institute papers dealing authoritatively with subjects of import in the fields of physical science and engineering.

SEC. 5. The Committee on Science and the Arts shall consist of sixty members who shall serve three years. Twenty shall be elected each year by the Board of Managers at the first meeting after the annual election. The Committee shall investigate current discoveries, inventions and other achievements of workers in the physical sciences and their application in the mechanic and industrial arts with a view of affording such recognitions as lie within the power of the Institute to bestow.

SEC. 6. These committees shall organize and adopt rules and regulations suitable to their several activities, subject to the approval of the Board.

ARTICLE X.—*Meetings*

SECTION 1. The Institute shall hold stated meetings on the third Wednesday of each month, except in June, July, August, and September. That on the third Wednesday in January of each year shall be the annual meeting.

SEC. 2. Special meetings shall be called by order of the President, upon request of the Board of Managers, or the written application of twelve members of the Institute. Fifteen members shall constitute a quorum.

ARTICLE XI.—*Amendments*

These By-Laws may be altered or amended at any stated meeting of the members of the Institute, provided notice in writing, signed by two members, of the proposed alteration or amendment, shall be given to the Board of Managers two months prior to the said meeting, except that amendments to Article I, relating to capital stock, must be ratified subsequently by a majority of the stock represented at a meeting specially called for this purpose.

BY-LAWS OF THE BOARD OF MANAGERS

Organization Meeting.

A meeting for the purpose of organizing, electing members of the Committee on Science and the Arts, appointing a Secretary, an Assistant Secretary and Librarian, a Controller and Standing Committees, shall be held on the fourth Wednesday in January, at 4.15 o'clock, P.M.

Stated Meetings.

Stated meetings shall be held on the second Wednesday of each month at 12.30 o'clock, P.M.

Order of Business.

1. Calling the roll.
2. Reading the minutes of the previous meeting.
3. Report from Treasurer.

4. Reports from Standing Committees of the Board of Managers:
 - (a) Finance.
 - (b) Membership.
 - (c) Publications.
 - (d) Bartol Research Foundation.
 - (e) Endowment.
 - (f) Executive.
5. Reports from Standing Committees of the Institute:
 - (a) Library.
 - (b) Meetings.
 - (c) Museum.
 - (d) Science and the Arts.
6. Reports from Special Committees.
7. Deferred Business.
8. New Business.

Reports.

All committees of the Board shall keep regular minutes of their proceedings and shall report monthly to the Board; they shall also report, through the Committee on Finance, to the stated meeting of the Board in September, an estimate of moneys they require for the service of the ensuing year.

AWARDS BY THE INSTITUTE

The following awards are made by The Franklin Institute:

The Franklin Medal.
The Elliott Cresson Medal.
The Howard N. Potts Medal.
The Louis Edward Levy Medal.
The George R. Henderson Medal.
The John Price Wetherill Medal.
The Edward Longstreth Medal.
The Certificate of Merit.
The Boyden Premium.

The making or recommending of these awards is, by resolution of the Institute, entrusted to its Committee on Science and the Arts, a Committee consisting of sixty members of the Institute. This Committee recommends to the Institute the award of the Franklin Medal to distinguished scientists or technologists; and investigates, upon application, and reports on any worthy invention, discovery or process, recommending the award, according to merit, of the Elliott Cresson Medal, the Howard N. Potts Medal, the John Price Wetherill Medal, the Edward Longstreth Medal, or the Certificate of Merit.

The Franklin Medal (Gold Medal and Certificate).—This medal is awarded annually from the Franklin Medal Fund, founded January 1, 1914, by Samuel Insull, Esq., to those workers in physical science or technology, without regard to country, whose efforts, in the opinion of the Institute, acting through its Committee on Science and the Arts, have done most to advance a knowledge of physical science or its applications.

The Elliott Cresson Medal (Gold Medal and Certificate).—This medal is awarded for discovery or original research, adding to the sum of human knowledge, irrespective of commercial value; leading and practical utilizations of discovery; and invention, methods of products embodying substantial elements of leadership in their respective classes, or unusual skill or perfection in workmanship.

The Howard N. Potts Medal (Gold Medal and Certificate).—This medal is awarded for distinguished work in science or the arts; important development of previous basic discoveries; inventions or products of superior excellence or utilizing important principles.

The Louis E. Levy Medal (Gold Medal and Certificate).—This medal is awarded to the author of a paper of especial merit, published in the JOURNAL OF THE FRANKLIN INSTITUTE, preference being given to one describing the author's experimental and theoretical researches in a subject of fundamental importance.

The George R. Henderson Medal (Gold Medal and Certificate).—This medal is awarded for meritorious inventions or discoveries in the field of railway engineering.

The John Price Wetherill Medal (Silver Medal and Certificate).—This medal is awarded for discovery or invention in the physical sciences, or for new and important combinations of principles or methods already known.

The Edward Longstreth Medal (Silver Medal and Certificate).—This medal, with a money premium when the accumulated interest of the fund permits, is awarded for meritorious work in science or the arts. In the event of an accumulation of the fund for medals beyond the sum of one hundred dollars, it is competent for the Committee on Science and the Arts to offer from such surplus a money premium for some special work on any mechanical or scientific subject that is considered of sufficient importance.

The Certificate of Merit.—A Certificate of Merit is awarded to persons adjudged worthy thereof for their inventions, discoveries or productions.

The Boyden Premium (Premium of \$1000).—To any resident of North America who shall determine by experiment whether all rays of light and other physical rays are or are not transmitted with the same velocity.

HISTORY OF THE MEDALS

The Franklin Medal.—Samuel Insull, Esq., of Chicago, Illinois, writing under date of December 23, 1913, to the Board of Managers, stated that he had been informed it would be a source of gratification to them if the Institute had available, in addition to such medals already in its gifts, a medal to be known as The Franklin Medal, and to be awarded from time to time in recognition of the total contributions of individuals to science or to the applications of physical science to industry, rather than in recognition of any single invention or discovery, however important. He agreed to provide for the founding of this medal under the following general conditions:

1. That an amount not exceeding one thousand dollars should be furnished by him for procuring appropriate designs and dies for the medal and diploma.

2. That the medal should possess distinct artistic merit, and have on one side a medallion of Benjamin Franklin done from the Thomas Sully portrait in the possession of the Institute.

3. That the medal should be of gold and have an intrinsic value of about seventy-five dollars.

4. That the sum of five thousand dollars should be provided by him to be held in trust in perpetuity to be a foundation for this medal, and to be known as The Franklin Medal Fund (Founded January 1, 1914, by Samuel Insull, Esq.).

5. That the interest of this fund should be used from time to time in awarding The Franklin Medal to those workers in physical science or technology, without regard to country, whose efforts have, in the judgment of the Institute, done most to advance a knowledge of physical science or its applications.

6. That any excess of income from this fund, beyond such average annual sum as might be deemed necessary by the Institute for the number of medals it is considered best to award, might be used for premiums to accompany the medals.

The Elliott Cresson Medal.—Under date of February 18, 1848, Elliott Cresson, Esq., of Philadelphia, Pennsylvania, conveyed to the Trustees for The Franklin Institute one thousand dollars of the six per cent. convertible loan of the President, Managers and Company of the Schuylkill Navigation Company—to hold the said sum and the interest to accrue thereon, for the following uses and purposes:

1. The Trustees to keep the principal invested as it now (1848) is until it is reimbursed by the said Company, and immediately after such reimbursement to reinvest the said principal of one thousand dollars in such securities, bearing interest, as may by law be designated for the investment of trust funds. And from time to time, as the said principal sum may be reimbursed, to reinvest the same in like manner.

2. To cause suitable dies to be prepared for striking the gold medal out of the first sufficient moneys received for interest on the said sum of one thousand dollars, the dies to bear the following devices and inscription:: The obverse—a medallion likeness of the said Elliott Cresson with inscription around the margin, "Elliott Cresson Medal, A.D. 1848." Reverse—around the margin, "Awarded by The Franklin Institute of Pennsylvania." The centre to be filled by engraving the name of the party to whom awarded and the year in which the award is made.

3. After the said dies have been prepared, and paid for out of the money received for interest, the said Trustees to cause to be struck, from time to time, such number of gold medals as the interest received will pay for, and to deliver the same to the Treasurer of The Franklin Institute, to be by him transmitted to such persons or parties as the said Franklin Institute may have awarded the same; the said awards, however, to be in all instances made either for some discovery in the arts and sciences, or for the invention or improvement of some useful machine, or for some new process or combination of materials in manufactures, or for ingenuity, skill or perfection in workmanship.

The Howard N. Potts Medal.—Howard N. Potts, Esq., of Philadelphia, Pennsylvania, died July 24, 1906, leaving a will in which he provided for the establishment of this medal as follows:

"I give and bequeath to The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts and its successors, the sum of one thousand dollars, without deduction for taxes or charges; in trust to invest the same and apply the income thereof or such part or portion of it as may be adequate for the purpose, from time to time, to the purchase of a gold medal, to be awarded in the name of the said Franklin Institute for distinguished work in science or the mechanic arts."

The Louis E. Levy Medal.—Under date of December 12, 1923, the following letter was received from Mr. Lionel F. Levy, a member of the Committee on Science and the Arts:

"To The Board of Managers of

"The Franklin Institute of The State of Pennsylvania,

"Philadelphia, Pennsylvania.

"Gentlemen:

"Understanding from my associates on your Committee on Science and the Arts that a feeling obtains among them that the purposes of the Institute would be aided should there be available to the Institute a medal for the recognition of contributions to the JOURNAL, I take the liberty of addressing you to say that my brother, Mr. Howard S. Levy, my sister, Miss Hortense Levy, and I will be glad to found a medal in memory of our Father, the late Louis E. Levy, under the following general conditions:

"First: That we furnish a sum not exceeding five hundred (\$500) dollars to cover the cost of an appropriate design and the necessary dies and diplomas.

"Second: That the medal be of gold and have an intrinsic value of about sixty (\$60) dollars.

"Third: That we furnish the sum of two thousand (\$2000) dollars to be known as the Louis E. Levy Medal Fund.

"Fourth: That the interest on this fund shall be used from time to time in awarding the Louis E. Levy Medal for papers contributed to the JOURNAL of the Institute, descriptive of the author's researches in physical science or of his engineering achievements, which have added largely to the sum of knowledge or aided greatly the well-being of mankind.

"Fifth: That any excess of income from this fund beyond that necessary for the number of medals which the Institute may think best to award shall be added to the Louis E. Levy Library Fund.

"I am,

"Very truly yours,

"(Signed) LIONEL F. LEVY."

This matter was brought to the attention of the Board of Managers at their meeting on December 12, 1923, and the proposed fund was accepted.

The George R. Henderson Medal.—Under date of September 24, 1924, the following communication was presented to the Acting Secretary:

"I herewith present to The Franklin Institute the sum of two thousand five hundred dollars (\$2500). Of this amount a sufficient sum is to be used for the cost of preparing dies for a medal to be known as the George R. Henderson Gold Medal which is to be awarded by the Institute on the recommendation of the Committee on Science and the Arts for meritorious inventions or discoveries in the field of railway engineering. The remaining amount is to constitute a fund in trust, the net income from which, or such portion thereof as may be needed, shall be used for the purchase of the said gold medal as required.

"Any accumulation after providing the medals shall, after each period of five years, be added to the trust fund, and if this fund increases to double

the original amount, one-half the net income may be used to provide the Henderson Medal for inventions in other fields than railway engineering.

"(Signed) VIRGINIA P. C. HENDERSON."

This was presented to the Board of Managers for consideration at their meeting on October 8, 1924, and was duly accepted.

The John Price Wetherill Medal.—On April 3, 1917, the family of the late John Price Wetherill gave to The Franklin Institute a certain sum as the first contribution toward the establishment of a Fund for the promotion of research, to be known as "The John Price Wetherill Memorial Research Fund."

On June 10, 1925, the Board of Managers of The Franklin Institute, in accordance with the desires of the family of Mr. Wetherill, voted to set aside as much of this Fund as might be necessary, for the design and production of a silver medal, to be known as "The John Price Wetherill Medal," and to be awarded for discovery or invention in Physical Sciences, or for new and important combinations of principles or methods already known.

The obverse of the medal bears a profile relief of Mr. Wetherill and is inscribed around the margin—"The John Price Wetherill Medal 1925."

The reverse bears the legend: "Awarded by The Franklin Institute to _____ for discovery, invention, or development in the physical sciences."

The Edward Longstreth Medal.—In the month of May, 1890, Edward Longstreth, Esq., of Philadelphia, Pennsylvania, retired member of The Baldwin Locomotive Works, deposited with The Franklin Institute in trust, a registered bond of the Baltimore Traction Company for the sum of one thousand dollars, for the founding and perpetuation of the Edward Longstreth Medal of Merit; the interest accruing from said principal sum to be used in procuring and awarding said medals for the encouragement of invention, and in recognition of meritorious work in science and the industrial arts; the said awards to be made by The Franklin Institute through its Committee on Science and the Arts, under such rules as said Committee may adopt.

This donor further presented to The Franklin Institute twelve silver medals and the die therefor designed and executed under the direction of a committee of the Institute with his approval.

On May 14, 1890, the Board of Managers of The Franklin Institute, by resolution, accepted on behalf of the Institute the gifts of the donor, and on September 17, 1890, the Institute, by resolution following, confirmed the acceptance:

"Resolved, That the Institute hereby confirms the action of the Board of Managers in accepting the gift of foundation of the Edward Longstreth Medal of Merit, and in expressing its grateful acknowledgments for the gift.

"Resolved, That the grant of the Edward Longstreth Medal, in accordance with the wishes of the donor, be entrusted to the Committee on Science and the Arts, subject to such conditions as the said Committee, with the approval of the Institute, may propose."

The obverse of the medal bears the effigy of the donor, and is inscribed around the margin, "The Edward Longstreth Medal of Merit, Founded 1890."

On the reverse is inscribed around the margin, "Awarded by The Franklin Institute," and in the centre is engraved the name of the recipient with the date and object of award.

On March 19, 1913, Charles Longstreth, son of the above-named Edward Longstreth, deposited with The Franklin Institute the further sum of one thousand dollars to be added to the original fund to be kept with it in trust in perpetuity, the interest to be used as is the interest of the original fund.

The Certificate of Merit.—At the stated meeting of the Institute, held on June 21, 1882, the following resolution was adopted:

"Resolved, That the Committee on Science and the Arts of The Franklin Institute is hereby authorized to award, and issue to persons by said Committee adjudged worthy, a Certificate of Merit for their inventions, discoveries or productions, which certificate shall read as follows:

"The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, awards to _____ this Certificate of Merit. This award is made pursuant to the recommendation of the Committee on Science and the Arts.

"Report No. _____ Approved, _____ 19 _____

"_____ President.

"[SEAL]

_____ Secretary.

"Chairman of the Committee on Science and the Arts.'"

The Boyden Premium.—On March 23, 1859, Uriah A. Boyden, Esq., of Boston, Massachusetts, deposited with The Franklin Institute the sum of one thousand dollars to be awarded as a premium to any resident of North America who shall determine by experiment whether all rays of light, and other physical rays, are or are not transmitted with the same velocity.

The problem has been more specifically defined by the Board of Managers, as follows:

"Whether or not all rays in the spectrum known at the time the offer was made, namely, March 23, 1859, and comprised between the lowest frequency known thermal rays in the infra-red, and the highest frequency known rays in the ultra-violet, which in the opinion of the Committee lie between the approximate frequencies of 2×10^{14} double vibrations per second in the infra-red and 8×10^{14} in the ultra-violet, travel through free space with the same velocity."

An award, made during the year 1907, covered the solution of the problem so far as the transmission of the visible and ultra-violet rays is concerned. It has been directed by the Board of Managers that the balance of the fund be retained, to be awarded to such person as shall demonstrate whether or not the infra-red rays are or are not transmitted with the same velocity as the other rays.

REGULATIONS OF THE COMMITTEE ON SCIENCE AND THE ARTS

ARTICLE I.—*Investigations*

SECTION 1. The Committee shall investigate, by sub-committee or otherwise, any subject referred to it by the Institute or by any of its sections; and upon a majority vote of the members present at any stated meeting, it may investigate any subject presented on motion of a member or by application as herein provided.

SEC. 2. Secret processes or compounds will not be considered by the Committee; nor will the treatment of materials by any substance be considered, unless the composition used and the method of treatment are fully disclosed.

SEC. 3. A request or a recommendation for the investigation of a subject shall be made in writing addressed to the Secretary who will submit it with full detailed information to the Sub-committee on New Subjects and Preliminary Examination. If this Sub-committee recommends it as a suitable subject for investigation to the Committee on Science and the Arts, and if this recommendation is adopted by the General Committee, the Secretary shall notify the applicant accordingly and furnish an application blank substantially like the form appended.

SEC. 4. It shall not be competent for any member of the Committee on Science and the Arts to be an applicant for investigation unless the subject for investigation be referred to the Committee by a vote of the Institute.

ARTICLE II.—*Meetings of the Committee*

SECTION 1. The Committee shall hold stated meetings at 8 o'clock P.M. on the first Wednesday of each month, excepting July, August and September.

SEC. 2. Special meetings may be called by the Chairman, and shall be called by him upon the written request of five members of the Committee.

SEC. 3. At all meetings of the Committee nine members shall constitute a quorum for transacting general business, but for final action upon a report conferring or recommending an award or for amending the rules of the Committee, a quorum shall consist of not less than fifteen members.

SEC. 4. At its stated meetings the Committee shall proceed in the following

Order of Business:

1. Calling the roll.
2. Reading of the minutes of preceding meeting.
3. Approval of bills.
4. Reading of correspondence.
5. Report of sub-committee on new subjects and preliminary examination.
6. Reports of standing and special sub-committees.
7. Consideration of reports for final action.

8. Reports of sub-committees on investigation, first reading.
9. Deferred business.
10. New business.
11. Adjournment.

ARTICLE III.—*Chairman*

SECTION 1. A Special Committee for nominating a Chairman for the ensuing year, consisting of three recent past Chairmen, shall be appointed at the January Meeting of the Committee, this special committee to report its nomination of a candidate at the February meeting. At this meeting, additional nominations may be made by any member of the Committee on Science and the Arts. The election shall be by ballot at the same meeting, when the person receiving the highest number of votes shall be declared elected. He shall immediately assume office and shall perform his duties until his successor is installed. He shall not be eligible for election in two successive terms.

SEC. 2. The Chairman shall appoint the members of all sub-committees unless otherwise ordered, and may serve *ex officio* on all sub-committees except those charged with investigations.

SEC. 3. The election of a member as Chairman shall be held to vacate his membership of any and all sub-committees of investigation on which he may be serving, except if he has the report of such Committee prepared or in preparation, in which case he shall complete his work, but when such report is presented for consideration, he shall call on another member to preside while the subject is under discussion.

SEC. 4. The Chairman shall submit to the stated meetings of the Board of Managers in October, December, February, April and June of each year, a report of the number of investigations pending before the Committee, the number disposed of since the last report, with the action taken or award made in each case, and the number and nature of new investigations undertaken since the last report, and such other information as to the work of the Committee as the Board of Managers may require. He shall also report to the stated meetings of the Institute such recent action of the Committee as he may deem of interest.

ARTICLE IV.—*Standing Sub-committees*

SECTION 1. There shall be appointed each February by the Chairman a sub-committee of not less than five members of the Committee, to be styled the "Sub-committee on New Subjects and Preliminary Examination." The duties of this sub-committee shall be to keep a general observation of progress made in science and the arts and to report to the Committee subjects adjudged worthy of investigation; to coöperate with the Secretary in keeping the work of the Committee properly before the public, and to recommend at each regular meeting the acceptance or otherwise of all applications for investigation. This sub-committee shall meet at least once prior to each regular meeting of the Committee.

SEC. 2. There shall be appointed each February by the Chairman, from the membership, a sub-committee styled the "Sub-committee on Literature," consisting of six members. It shall be the duty of this sub-committee to examine carefully all papers that are published in the Institute's JOURNAL during

the current calendar year, and to report to the Committee not later than January of the following year, which, if any, of those papers deserve the award of the Louis Edward Levy Medal.

SEC. 3. There shall be appointed by the Chairman from the membership each February, a sub-committee styled the "Sub-committee on Awarding the Franklin Medal," the duty of which shall be to make recommendations of the award of this medal under the provisions of the deed of gift.

ARTICLE V.—*Sub-committees on Investigation of Applications*

SECTION 1. Upon the acceptance of an application for investigation, a sub-committee shall be appointed by the Chairman to conduct the investigation.

SEC. 2. Sub-committees shall be appointed from the membership of the Committee, but they may include a minority of other persons whose expert services are desired in the examination.

SEC. 3. When the personnel of a sub-committee on investigation is finally determined, a notice shall be sent to all members thereof giving the names of the members of the sub-committee.

SEC. 4. No person who is interested in the issue shall be a member of the sub-committee on investigation.

SEC. 5. An applicant for investigation may withdraw his application at any time before final action by the Committee; which withdrawal shall be reported to the Committee.

SEC. 6. When the Secretary has obtained the necessary information from the applicant, he shall notify the sub-committee, who shall then proceed with the investigation.

SEC. 7. Correspondence between the sub-committee and the applicant must be carried on through the office of the Secretary, in order that the official records shall be complete.

SEC. 8. Sub-committees shall whenever possible make direct examination and tests of the subject under investigation, and shall not accept tests, data or information furnished by others without first satisfying themselves as to the accuracy thereof. They shall in no case recommend an award solely on the basis of tests, data or information furnished by parties in any way interested in the subject of the award. When data submitted by persons not members of the sub-committee are included in the latter's report, it shall be so stated.

SEC. 9. Sub-committees must ascertain that articles, processes, products, etc., examined are genuine samples of the subject under investigation.

SEC. 10. Each sub-committee on investigation shall report its progress to the Committee at intervals of not more than two consecutive stated meetings; and any sub-committee failing so to report for four consecutive stated meetings may be discharged from further consideration of the subject at the discretion of the Chairman, who shall then appoint a new sub-committee to continue the investigation.

SEC. 11. Any member of a sub-committee on investigation failing to discharge his duties may be replaced by another member at the discretion of the Chairman.

SEC. 12. Sub-committees may request applicants to furnish drawings, diagrams or other exhibits for the purpose of investigations and for the records of the Committee.

SEC. 13. When it is found that the subject under investigation has become involved in litigation, the sub-committee shall defer further action until the litigation is terminated, or the Committee decides that the sub-committee may proceed.

ARTICLE VI.—*Sub-committee Meetings*

SECTION 1. A quorum for the transaction of business at any meeting of a sub-committee, properly called, shall consist of the one or more members present.

SEC. 2. No applicant or other person interested in the issue of an investigation shall be present at a meeting of a sub-committee or of the Committee except at the invitation of the sub-committee charged with the investigation.

ARTICLE VII.—*Sub-committees' Reports*

SECTION 1. Reports of progress and final reports of sub-committees shall be made to the Committee in writing. Final reports shall begin and end substantially as indicated in Form B hereto appended.

SEC. 2. When a sub-committee on investigation deems the subject upon which it reports worthy of an award of the Elliott Cresson Medal, the George R. Henderson Medal, the Howard N. Potts Medal, the John Price Wetherill Medal, the Edward Longstreth Medal or the Certificate of Merit, it shall include in its report a recommendation to that effect; and such recommendations may be adopted by a majority vote of the Committee, but shall not be changed except by a vote of two-thirds of the members present.

SEC. 3. A report of a sub-committee on investigation, before its acceptance by the Committee, may be edited by the Secretary of the Institute in conjunction with the Chairman of the sub-committee, but without changing its meaning or effect.

SEC. 4. A report of a sub-committee on investigation, before its acceptance by the Committee, shall be signed by a majority of the members of the sub-committee charged with the investigation.

SEC. 5. Any member or members of a sub-committee may file a minority report at least three days prior to the meeting at which the majority report is to be presented.

SEC. 6. No member of a sub-committee shall be permitted to sign a report without having personally examined the subject under investigation, or taken part in its discussion at a meeting of the sub-committee.

SEC. 7. Reports of sub-committees on investigation shall be accompanied by such drawings, diagrams or other exhibits as will serve to elucidate the subject.

SEC. 8. All exhibits pertaining to reports shall be numbered, marked for identification, and signed by the Secretary of the Institute in substantially the following form, and the seal of the Institute shall be impressed thereon:—

Exhibit No. ———, pertaining to report of the Committee on Science and the Arts No. ———

Secretary.

SEC. 9. After the report of a sub-committee on investigation has passed its first reading before the Committee, a copy of its descriptive portion may be furnished the applicant, who may make an explanation or objections, in writing, addressed to the Chairman of the Committee; but such writing must be received not later than the next stated meeting of the Committee.

SEC. 10. The report of a sub-committee on investigation may be discussed and amended at the meeting of the Committee at which it is first presented, but shall be laid over for a second reading and final action until the next stated meeting; except where no recommendation of an award is made in the report, when it may, by a majority vote, be finally disposed of at the time of the first reading.

SEC. 11. Final action on a report of a sub-committee on investigation recommending an award shall not be taken unless at least one member of the sub-committee who signed the report is present.

ARTICLE VIII.—*Reconsideration*

SECTION 1. Upon the adoption of a report of a sub-committee, a motion for reconsideration must be made within the next three months. If such a motion is made and accepted, a vote of two-thirds of a quorum for final action shall be required to change the report as previously adopted.

SEC. 2. A second investigation of a subject shall not be ordered except on a vote of two-thirds of the members present at a stated meeting.

ARTICLE IX.—*Advertisement of Recommendations*

SECTION 1. Upon the adoption, by the Committee on Science and the Arts, of a report of a sub-committee on investigation setting forth that a discovery, invention, improvement or manufacture is worthy of an award of the Elliott Cresson Medal, the Howard N. Potts Medal, the George R. Henderson Medal or the John Price Wetherill Medal, publication shall be made in three successive issues of the JOURNAL OF THE FRANKLIN INSTITUTE, stating that at the expiration of three months from the date of the first publication, the person making such discovery, invention, improvement or manufacture shall be entitled to receive the award of the said medal, unless within the time satisfactory evidence shall have been submitted to the Committee on Science and the Arts of the want of originality or merit, in the supposed discovery, invention, improvement or manufacture.

SEC. 2. The adoption by the Committee on Science and the Arts of a report of a sub-committee recommending an award of the Franklin Medal, the Louis Edward Levy Medal, the Edward Longstreth Medal or the Certificate of Merit, shall be conclusive without advertisement.

ARTICLE X.—*Protests*

SECTION 1. Protests against recommendations advertised by publication in the JOURNAL must be received within three months of the date of first publication. Such protests shall be presented to the Committee at its next

stated meeting following date of receipt, and shall be affirmed only by a vote of two-thirds of a quorum for final action, in which case a re-investigation shall be made.

ARTICLE XI.—*Institute Reports*

SECTION 1. Reports issued by the Institute shall begin and end substantially as in Form C appended. They shall be written upon an official form provided by the Institute.

SEC. 2. Reports when issued shall state that they are the action of The Franklin Institute by its Committee on Science and the Arts. They shall be attested by the President and the Secretary of the Institute and by the Chairman of the Committee, and shall be impressed with the seal of the Institute; and they may also bear the names of the members who signed the sub-committee's report.

SEC. 3. On the completion of an investigation, the applicant shall be provided with a certified copy of the Institute's report.

ARTICLE XII.—*Amendments to Regulations*

SECTION 1. Proposals to amend these regulations shall be presented to the Committee in writing, signed by at least two members. They may be considered when presented, but shall not be acted upon until the next stated meeting after presentation, and shall then be adopted if agreed to by two-thirds of the required quorum.

SEC. 2. Notice of proposed amendments shall be sent to each member on the programme for the meeting at which they may be acted upon.

Since much latitude is allowed by the terms of the several medal bequests and no rules for the making of Institute awards conflicting with the purpose and intent of the donors can be made, it is obviously not the part of wisdom to attempt too much in the way of definition. It is suggested that future awards be made with the following general understanding:

1. That the Certificate of Merit be awarded for meritorious inventions and physical processes.

2. That the Edward Longstreth Medal be awarded for invention of high order and for particularly meritorious improvements and developments in machines and mechanical processes.

3. That the John Price Wetherill Medal be awarded for discovery or invention in the physical sciences, or for new and important combinations of principles or methods already known.

4. That the Howard N. Potts Medal be awarded in recognition of important discoveries in physical science.

5. That the George R. Henderson Medal be awarded in recognition of meritorious inventions or discoveries in the field of railway engineering.

6. That the Elliott Cresson Medal be awarded in recognition of inventions of signal value and fundamentally important in the arts and industries.

7. That the Louis Edward Levy Medal be awarded in recognition of papers contributed to the JOURNAL of the Institute, which are of superior excellence and descriptive of a field in science or engineering to which the author has contributed fruitful research.

8. That the Franklin Medal continue to be awarded to those whose efforts have contributed most to a knowledge of physical science and its applications.

REPORT FORMS OF COMMITTEE ON SCIENCE AND THE ARTS

FORM A

(Application for Investigation)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

In the matter of your application to The Franklin Institute for a consideration of your invention or discovery entitled the following data are requested for the information of the Committee on Science and the Arts:

1. What is the specific purpose of the invention?
2. What is the condition of the prior art in this regard?
3. What improvement is claimed to be effected by the invention?
4. How is the improvement effected?
5. What patents, if any, have been issued for this invention?
6. What citations, if any, were made in this regard by the Patent Office before allowance of patent claims?
7. Is the invention now in actual use?
8. If so, since when?
9. Where may it be seen in operation?
10. Are you prepared to submit drawings of the apparatus or device?
11. Are you prepared to submit a model of the apparatus or device?
12. If the invention is a composition of matter, are you prepared to submit specimens of the ingredients and of the compound sufficient for the purpose of experiments?
13. If the invention is a chemical process, are you prepared to give a demonstration of the same?

IMPORTANT TO APPLICANT

This application carefully filled in and other available matters descriptive of the invention or process, together with two copies of each of the United States patents issued to applicant, must be returned promptly to the Secretary of The Franklin Institute, 15 South Seventh Street, Philadelphia, Pa.

(A copy of Form A, above, may be obtained from the Secretary of the Institute and must be filled in, signed and promptly returned by an applicant for an examination of and a report upon an invention or discovery.)

YEAR BOOK OF

FORM B

(Sub-committee Report Form)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

S. & A. Case No.

REPORT OF SUB-COMMITTEE, dated

Investigating

TO THE COMMITTEE ON SCIENCE AND THE ARTS:

Your sub-committee appointed to investigate the above subject reports
as follows:

.....

In consideration of the {
discovery
excellence of construction
ingenuity and novelty
or

of your sub-committee recommends

the award of to of

Respectfully submitted,

..... Chairman.

.....

.....

.....

Adopted at the Stated Meeting of 19

FORM C

(Institute Report Forms)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

HALL OF THE INSTITUTE,

Philadelphia,

S. & A. Case No.

The Franklin Institute of the State of Pennsylvania, acting through its
Committee on Science and the Arts, investigating
..... reports as follows :

In consideration of the {
discovery
excellence of construction
ingenuity and novelty
or

of the Institute awards the.....

to of

..... *President.*

[SEAL]

..... *Secretary.*

Countersigned

Chairman of the Committee on Science and the Arts.

FORM B

(Sub-committee Report Form)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

S. & A. Case No.

REPORT OF SUB-COMMITTEE, dated

Investigating

TO THE COMMITTEE ON SCIENCE AND THE ARTS:

Your sub-committee appointed to investigate the above subject reports
as follows:

.....

In consideration of the {
discovery
excellence of construction
ingenuity and novelty
or

of your sub-committee recommends

the award of to of

Respectfully submitted,

..... Chairman.

.....

.....

.....

Adopted at the Stated Meeting of 19

FORM C

(Institute Report Forms)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

HALL OF THE INSTITUTE,

Philadelphia,

S. & A. Case No.

The Franklin Institute of the State of Pennsylvania, acting through its
Committee on Science and the Arts, investigating
..... reports as follows:

.....

In consideration of the {
discovery
excellence of construction
ingenuity and novelty
or

of the Institute awards the.....

.....

to of

..... President.

[SEAL]

..... Secretary.

Countersigned

Chairman of the Committee on Science and the Arts.

PRESIDENT'S REPORT AND REPORTS OF THE COMMITTEES OF THE INSTITUTE AND THE COMMITTEES OF ITS BOARD OF MANAGERS

REPORT OF THE PRESIDENT

FOR THE YEAR ENDING DECEMBER 31, 1925

To the Members of The Franklin Institute:

It has long been the custom, and a very pleasant duty, for the President of the Institute to submit an Annual Report upon the activities of the Institute, making a survey of the work accomplished by the various committees of the Institute and by the Committees of the Board of Managers.

COMMITTEE ON MUSEUM.

The Committee on Museum, Dr. Alexander E. Outerbridge, Jr., Chairman, reports that a number of pieces of apparatus, models and interesting books and manuscripts have been added to the Institute's Museum during the past year. These donations have included specimens of eight electric lamps manufactured about 1883 or 1884, which were presented by Mr. Robert B. Haines, Jr., a member of the Institute. Note books, manuscripts and models of mechanical movements, formerly the property of Mr. John H. Cooper, a noted mechanical engineer, who was a member of the Board of Managers from 1870-1873, and an active member of the Committee on Science and the Arts, were presented by a grand-nephew of Mr. Cooper, Mr. Arthur S. Martin, 421 West Main Street, Norristown, Pennsylvania. The Pennsylvania Railroad Company has promised to donate some very significant models of early railroad apparatus. The Committee states this anticipated gift and the present invaluable possessions of the Institute bring home in a striking way the needs of the Institute for a proper museum. Until our collections, which are increasingly interesting and valuable, are housed under proper conditions, the Institute will be unable to perform its maximum service to the public.

COMMITTEE ON PUBLICATIONS.

The Committee on Publications, Mr. E. H. Sanborn, Chairman, reports the noteworthy fact that the December number of the JOURNAL OF THE FRANKLIN INSTITUTE completes the two hundredth volume of the JOURNAL, and one hundred years of uninterrupted publication of this periodical—an almost unique record—no other case of such a protracted and uninterrupted period of publication of a journal of similar purpose being known to the members of this Committee. With the establishment of active research work under the Bartol Research Foundation, the pages of the JOURNAL will be enriched by the record of active research work, in addition to reports upon matters of general interest in science and upon inventions. During this period there have been additional sales of 176

copies of Dr. W. J. Humphreys' lectures on the "Physics of the Air," and 142 copies of Sir Joseph J. Thomson's collected articles on the "Electron in Chemistry."

COMMITTEE ON MEETINGS.

The Committee on Meetings submits an interesting summary of the various meetings and lectures held during the past year. There was a total attendance of 743 at the eight stated meetings of the Institute. Nine other meetings with a total attendance of 896 were held. These meetings were all of an unusually high character and constituted a valuable addition to the long list of topics presented before the Institute during the past years. At the Meeting of May 20, 1925, the annual award of The Franklin Medal was made in recognition of distinguished scientific and technical achievements. Dr. Karl T. Compton, of Princeton University, made a statement relative to the work of Dr. Pieter Zeeman, of the University of Amsterdam, who was awarded The Franklin Medal "in recognition of his numerous and important contributions in the field of magneto-optics and particularly of his discovery of the effect of a magnetic field upon the frequencies of the light from a radiating source." Mr. A. Loudon, Secretary, Royal Netherland Legation, Washington, D. C., representing the Netherland Minister, Jonkheer Doctor de Graeff, was presented to the Chairman and received from him The Franklin Medal, accompanying certificate, and Certificate of Honorary Membership in the Institute, awarded to Doctor Zeeman. Mr. Loudon expressed appreciation of the high honor conferred upon his distinguished countryman. Dr. E. W. Rice, Jr., Honorary Chairman of the General Electric Company, described the work of Dr. Elihu Thomson, of Lynn, Massachusetts, who was awarded The Franklin Medal "in recognition of his pioneer work in the field of electricity and electrical engineering and of his numerous inventions in these fields." Doctor Thomson, fortunately, was able to be present, and he received from the Chairman, The Franklin Medal, accompanying certificate, and Certificate of Honorary Membership in the Institute. Doctor Thomson expressed his thanks for these honors. Dr. Arthur W. Goodspeed, of the Institute's Board of Managers, introduced the Hon. William Cameron Sproul, Ex-Governor of Pennsylvania, who had been elected to Honorary Membership in the Institute. The Certificate of Honorary Membership was presented to Governor Sproul, who expressed his appreciation of this recognition. Doctor Compton read the paper prepared by Doctor Zeeman for this meeting, on the "Magnetization of Spectrum Lines," after which Doctor Thomson presented his paper on "The Mechanical, Thermal and Optical Properties of Fused Silica."

COMMITTEE ON LIBRARY.

The Committee on Library, Mr. W. H. Fulweiler, Chairman, reports that there have been purchased, donated and obtained by increased binding, a total of 2521 accessions to the Library. These consist of 764 bound volumes, 223 unbound volumes 1528 pamphlets, and 6 maps. Grateful acknowledgment is made by the Institute to Mr. A. C. Albrecht, Mr. Clarence A. Hall, Dr. Samuel C. Hooker, Mr. S. S. Sadtler, Mr. John C. Trautwine, 3rd, Mrs. Coleman Sellers, Jr., Mr. C. F. Schaeffer, Dr. J. E. Whitfield, Harris and Richards, and the Shoemaker Bridge Company, for gifts of books, pamphlets and

magazines, and also to government departments, state and municipal officials, and numerous organizations which, from time to time, have supplied the Library with publications on technical subjects. The Committee's statement that the Library now consists of 83,927 bound and unbound volumes, 22,183 pamphlets, 2298 maps and charts, 1356 photographs, and 784 original drawings and designs, indicates in a striking way the growth of the Library. It is becoming increasingly difficult with the congested conditions of the present available facilities for housing the Library, to maintain it in an accessible and readily usable form. The efficiency of the Library and its usefulness to the members of the Institute and the general public are very seriously affected by these limitations.

COMMITTEE ON SCIENCE AND THE ARTS.

The Committee on Science and the Arts, Mr. Harold Calvert, Chairman, reports that investigation and final disposition were made of eighteen cases, and that thirteen cases are now pending. In fourteen of the eighteen cases investigated, awards were made; one case was tabled on account of legal complications, and one on account of the death of the inventor. The standing Sub-committees on Literature and The Franklin Medal held their customary meetings, and recommended the award of two Franklin Medals and one Levy Medal. The standing Sub-committee on New Subjects and Preliminary Examination held nine stated meetings during the year, and considered a total of fifty-two subjects. Applications were received covering ten of these subjects, and five special cases were accepted for investigation, for which no applications were required. The meetings of this Sub-committee were well attended, and careful consideration was given to the subjects presented. According to custom the awards to recipients who could personally attend the stated meetings of the Institute were presented by the President of the Institute.

In addition to The Franklin Medals which were awarded to Prof. Pieter Zeeman and Prof. Elihu Thomson, awards were made of the Louis Edward Levy Medal to Dr. Harvey C. Hayes, of Washington, D. C., of the Elliott Cresson Medal to Mr. Francis Hodgkinson, of Swarthmore, Pennsylvania; of the Edward Longstreth Medals to Mr. Thomas M. Chance, of Philadelphia, Mr. Daniel H. Meloche, of Detroit, and Mr. Thomas Midgley, Jr., of Dayton, Ohio. Medals for other recipients who were too far away to permit attendance at the stated meetings were mailed to them.

The Institute records with sorrow the death on December 18, 1925, of Mr. J. Y. McConnell, an active, efficient, and loyal member of the Committee on Science and the Arts for twenty-seven years.

Two features have marked this Committee's work during the past year; first, the establishment of the "John Price Wetherill Medal—1925," which will be "awarded for discovery or invention in the physical sciences or for new and important combinations of principles or methods already known." The Committee has long desired to have an additional medal, as it has been difficult in the past to equitably award the two medals available, namely, the Cresson and the Longstreth Medals, over a wide range of subjects of varying importance. The addition of the Wetherill Medal permits the Cresson Medal to be used for major discoveries and inventions, while this new medal can be used

for improvements or developments of a grade higher than those for which the Longstreth has been allotted. The Committee also feels that it is of interest to state that there has been a record-breaking attendance at its meetings during the past year.

COMMITTEE ON MEMBERSHIP.

The Committee on Membership, Mr. R. W. Lesley, Chairman, reports that 116 new members were elected. Resignations, members dropped for non-payment of dues, and the death of 12 members, bring the net increase in membership to 75. There are at present, in all classes of membership, 1410 members.

Two new classes of membership were established: First, Contributing Members (of these 44 being elected in 1925), representing industrial establishments in Philadelphia, eligible to this class of membership, which entitles them to the privilege of nominating 19 persons for election as Resident Members for the current year, subject to the discretion of the Board of Managers as to any particular nominee, the dues of these Resident Members being covered by the Annual Dues of \$300 paid by the Contributing Member. Second, the class of Student Membership, requiring only very low dues, has been established for boys and young men. By means of this class of membership it is expected that interest in The Franklin Institute will be awakened in the schools and collegiate institutions in and around Philadelphia. Another important activity in connection with increasing the membership has been the completion by a specially appointed committee, in conjunction with the Committee on Membership, of plans for continuing efforts to increase the membership of the Institute and to expand its usefulness. A circular letter has been prepared to which are attached the names of nineteen influential citizens of Philadelphia. These Committees have also prepared a circular which gives in readable form an outline of the history of the Institute, setting forth what the Institute has accomplished for the City and State. Large numbers of these documents have been printed, and will be used by all interested in the Institute, in efforts to increase the membership. Too high a value cannot be placed upon having a large membership, composed of individuals who may be expected to interest themselves in the Institute's work. There are undoubtedly many young men and others in industrial and allied work in Philadelphia who would be greatly benefited by membership in the Institute and the opportunity which it affords to broaden themselves in their various lines of activity.

COMMITTEE ON ENDOWMENT.

The Committee on Endowment, Mr. G. H. Clamer, Chairman, reports that the only endowment received during the fiscal year ending September 30, 1925, was one of \$10,000, from John Henry Towne, which will be known as the "John Henry Towne Memorial Fund." This Endowment Fund is without restriction as to use.

COMMITTEE ON FINANCE.

The Committee on Finance, Mr. Walton Forstall, Chairman. The total expenses of the Institute during the past year were \$62,080.22, and the total income \$51,467.92. Though this shows an operating deficit of \$10,612.30, there is an excess of assets over liabilities, of \$31,391.22 greater this year than last and

therefore, the figures show a definite gain. The principal and accumulated income of the Bartol Research Foundation Fund now amount to \$1,595,742.84. The expenses of the Bartol Foundation were \$34,652.02 and the income \$88,074.54, showing a surplus of \$53,422.52.

FRANKLIN FUND AND BUILDING COMMITTEE.

The Franklin Fund and Building Committee, Mr. Henry Howson, Chairman, has prepared a very complete report showing that there is now in this Fund \$1,000,000, this being the actual value of property (based on assessed valuations) and investments. The City of Philadelphia, through the Board of City Trusts, is the Trustee of this Fund.

COMMITTEE ON BARTOL RESEARCH FOUNDATION.

The Committee on Bartol Research Foundation, Mr. C. C. Tutwiler, Chairman, reports that a Director has not yet been appointed. Considerable progress has been made, however, in getting the work of the Foundation under way. Dr. W. F. G. Swann, of the Sloane Laboratory, Yale University, and Prof. E. P. Adams, of Princeton University, have been appointed to direct the scientific activities of the Foundation until a Director is chosen. Research work of a fundamental nature dealing with problems in electricity is being conducted under their direct supervision.

In addition, special investigations are being carried out at the Foundation's Laboratories by Professors Swann and Adams through their personal assistants. During the summer Doctor Swann conducted an experiment in Sweden with the idea of securing evidence of a Corpuscular Radiation of Cosmic Origin. The results of this investigation will be published in the JOURNAL OF THE FRANKLIN INSTITUTE as a contribution from the Bartol Research Foundation. The apparatus used by Doctor Swann was made in the machine shops of the Foundation.

One Fellow, Dr. Arthur Bramley, recently of Princeton University, has been appointed and is now engaged at the Foundation's Laboratories. Additional Fellows are under consideration, several of whom will probably be appointed as soon as they can be released from work upon which they are now engaged in other scientific institutions.

The Personnel Committee, consisting of Dr. W. F. G. Swann, Dean Jos. S. Ames, of the Johns Hopkins University, and Dr. Arthur L. Day, of the Geophysical Laboratory, Washington, is making a careful survey of the field with the idea of securing eight or ten Fellows: also a Director, who will be appointed as soon as a suitable man can be found for the position.

The routine work of the Foundation is being efficiently taken care of by the staff of The Franklin Institute under the able direction of the Secretary, Dr. Howard McClenahan.

While progress in getting the work of the Foundation under way has necessarily been slow, it is now proceeding at a rate which, it is thought, justifies the statement that it will be in full operation during the present year. In the meanwhile, as will be seen from the financial statement included in the Report of the Committee on Finance, a very considerable sum has been added to the principal account.

Arrangements have been made whereby the Bartol Research Foundation will reimburse The Franklin Institute for any assistance rendered by the Institute staff.

It is a matter of deep regret to all of us that Dr. Gellert Alleman, one of the Institute's Vice-presidents and Chairman of its Committee on Meetings, felt that the increasing demands of his own work rendered it necessary for him to withdraw from these activities. Doctor Alleman's leading part in the preparations for the Centenary Celebration of the Institute in September, 1924, and his close interest in all phases of our work cannot be too highly praised.

During the year, Dr. Howard McClenahan, formerly Dean of the College, Princeton University, was selected as Secretary of the Institute. Doctor McClenahan, by reason of his training and temperament, is well qualified to meet the responsibilities and carry on the work of the Secretaryship and the editorship of the JOURNAL. Doctor McClenahan has been most helpful both to the Institute and its Committees and to the Bartol Research Foundations.

Dr. George A. Hoadley, who, pending the selection of a new Secretary, very capably filled the office of Acting Secretary, has been elected Secretary of the Committee on Science and the Arts.

Mr. William F. Jackson, Jr., Controller, has been appointed Secretary of the Bartol Research Foundation Committee.

Lybrand, Ross Bros. and Montgomery, certified public accountants, audited the accounts for the fiscal year ended September 30, 1925, and reported them to be correct.

All of the work of the Institute and the Bartol Research Foundation is being carried on in an active, healthful way. Plans are under consideration and studies are being made by a Special Committee composed of the Chairmen of the various Committees and the Officers of the Institute to determine how the future needs can best be provided for.

Respectfully submitted,

WM. C. L. EGLIN,
President.

REPORT OF THE COMMITTEE ON LIBRARY

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1925

To the President and Members of The Franklin Institute:

The Committee on Library respectfully submits the following statement of activities in the library during the year ending September 30, 1925.

The additions to the library were as follows:

| Source. | Bound Volumes. | Unbound Volumes. | Pamphlets. | Maps. |
|-----------------------------|-------------------|---------------------|------------|-------|
| By Gift | 226 | 121 | 1514 | 1 |
| Binding | 349 | | | |
| Purchase | | | | |
| Books and Periodicals | 5 | 1 | | |
| Jayne Fund | 6 | 1 | | |
| Journal | 50 | 23 | 3 | |

| Source. | Bound Volumes. | Unbound Volumes. | Pamphlets. | Maps. |
|----------------------------|-------------------|---------------------|-------------|----------|
| Lea Fund | 17 | 4 | 1 | |
| Levy Fund | 12 | | | |
| Memorial Library Fund | 3 | | | |
| Miscellaneous Expense | 1 | 1 | | |
| Moore Fund | 34 | 2 | | 1 |
| Morris Fund | 29 | 2 | | |
| Potts Fund | 7 | . | | |
| Ware Fund | 25 | 68 | 10 | 4 |
| | <u>764</u> | <u>223</u> | <u>1528</u> | <u>6</u> |

Total additions2521

The Committee had at its disposal \$3100.00 appropriated by the Board of Managers and \$2792.01 income of the various trust funds.

The expenditures for the year were \$1008.32 for binding, \$4200.08 for books and subscriptions to magazines and other periodicals, \$144.94 for general expenses.

Gifts of books, pamphlets and magazines were received from Mr. A. C. Albrecht, Mr. Clarence A. Hall, Dr. Samuel C. Hooker, Mr. S. S. Sadtler, Mr. John C. Trautwine, 3rd, Mrs. Coleman Sellers, Jr., Mr. C. E. Schaeffer, Dr. J. E. Whitfield, Messrs. Harris and Richards, and Shoemaker Bridge Company.

The Institute is also under obligations to various government departments, state and municipal officials and to the numerous organizations who have from time to time supplied the library with publications on technical subjects.

The contents of the library on September 30, 1925, were:

| | |
|-------------------------------------|--------|
| Volumes, bound and unbound | 83,927 |
| Pamphlets | 22,183 |
| Maps and charts | 2,298 |
| Photographs | 1,356 |
| Original Drawings and Designs | 784 |

Binding:

During the year the following work was done by the binders:

| | |
|---|-----|
| Recent volumes of periodicals | 213 |
| Patent Office publications (British and American) | 136 |
| Volumes charged to the Ware Fund | 26 |
| Old volumes bound | 7 |
| Old volumes rebound | 1 |

Magazines and other periodical publications:

6410 copies of the JOURNAL were distributed for exchange purposes.

40 new exchanges were added to the mailing list and 21 were removed.

The total number of exchanges on September 30 was 523.

The subscriptions for the year totalled 211, of which 114 were domestic, 61 were German, 18 were English, 12 were French, 3 were Belgian, 2 were Italian and 1 was Australian.

The number of publications received by gift was 206, making the total periodical publications received by the library during the year 940.

In the latter part of the past year, arrangements were made to extend the book stack to the third floor and four double-face ranges of 15 feet each were erected. During this year two double-face ranges 18 feet each have been added and shortly several additional sections of shelving will be set up.

While this additional shelving will not relieve the congested condition of the library to any great extent, it will permit the proper placing and cataloging of the Ware Sugar Library.

The Library Committee wishes to call attention to the serious handicap under which the library is laboring at the present time, due to the large number of unbound publications.

At the present time these amount to some 10,300 volumes, and in their unbound state much of the material thus represented is almost unavailable and, in addition, presents a serious problem in proper storage.

The Library Committee earnestly hopes that some means may be found to relieve this situation which every year is decreasing the efficiency of the library and its usefulness to the members of the Institute and the general public.

No changes have occurred in the library staff during the past year.

Respectfully submitted,

W. H. FULWEILER,

Chairman.

PHILADELPHIA, January 13, 1926.

REPORT OF THE COMMITTEE ON MUSEUM

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1925

To, the President and Members of The Franklin Institute:

The following pieces of apparatus, models, and interesting books and manuscripts have been added to the Institute's collection during the last Institute year:

Eight electric lamps, being specimens of those manufactured about 1883 or 1884. Given by Mr. Robert B. Haines, Jr., member of the Institute.

Collection of notebooks, manuscripts and four models of mechanical movements formerly the property of John H. Cooper, noted mechanical engineer, member of the Board of Managers 1870-1873, and active on the Institute's Committee on Science and the Arts. Given by Mr. Arthur S. Martin, 421 West Main Street, Norristown, Penna., grandnephew of Mr. Cooper.

Some very significant models of early railroad apparatus have been promised to the Institute by the Pennsylvania Railroad Company. These will be accepted gratefully and will be cared for to the best possible advantage, with our present limited museum facilities. This anticipated gift and the present invaluable possessions of the Institute bring home in a striking way the needs of the Institute for a proper museum. Until our collections, which are increasingly interesting and valuable, are housed under proper conditions, the Institute will be unable to perform its maximum service to the public.

Respectfully submitted,

ALEXANDER E. OUTERBRIDGE, JR.,

Chairman.

PHILADELPHIA, January 13, 1926.

REPORT OF THE COMMITTEE ON MEETINGS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1925

To the President and Members of The Franklin Institute:

During the year ending September 30, 1925, there were eight Stated Meetings of the Institute, with a total attendance of 743. These were held on the third Wednesday of each month, from October to May inclusive, at the hour of eight o'clock, with the exception of the meeting on May 20, which was held at three-thirty o'clock in the afternoon. The following is a list of dates and speakers, with titles and synopses of their communications:

October 15, 1924: Professor Archibald Vivian Hill, O.B.E., D.Sc., F.R.S., Jodrell Professor of Physiology, University College, London, presented a paper on "The Ultimate Nature of the Muscular Machine." He described the employment of thermocouples and delicate deflection apparatus capable of indicating differences of 0.000001° Centigrade, by means of which he has followed the energy changes during the phases of muscular contraction and relaxation lasting in all only a fraction of a second. From these experiments he has made important deductions concerning the thermodynamics of the process and the nature of the mechanism involved. The subject was illustrated by lantern slides. At this meeting Dr. James Barnes, on behalf of the Committee on Science and the Arts, introduced Dr. Harvey Fletcher, of New York City, to whom was presented the Louis E. Levy Medal for his paper on "Physical Measurements of Audition and Their Bearing upon the Theory of Hearing," published in the JOURNAL of the Institute during 1923.

November 19, 1924: Dr. Harrison E. Howe, Editor of *Industrial and Engineering Chemistry*, Washington, D. C., read a paper on "The Trend and Purpose of Modern Research," which has since appeared in the February, 1925, issue of the JOURNAL. The frequent statements made concerning the importance of research, the constant appeals for funds to support it, and the increasing difficulty of giving publication to highly scientific research papers properly give rise to the questions: What is the trend and purpose of modern research? In what direction are the natural sciences, and particularly chemistry, headed? Are their problems such that if successful solutions were found the race may be expected to benefit? Answers to such questions are to be found in the types of problems being studied, particularly in the borderlands that exist between chemistry and biology, chemistry and physics, and chemistry as applied to the several major groups of engineering. Doctor Howe discussed a few of the problems that have to do with transportation, communication, public health and longevity, and indicated some of the work in progress, and some of the problems listed under the head of the chemist's unfinished business. At this meeting the Edward Longstreth Medal was presented to Mr. William F. Zimmermann, of Newark, N. J., for his invention of a hob for cutting worm gears and the method of making it.

December 17, 1924: Horace C. Porter, Ph.D., of Philadelphia, presented a paper on "Low Temperature Coal Carbonization and Its Prospective Industrial Application," which was accompanied by experimental demonstrations, samples of commercial products and lantern slides. The speaker pointed out that low temperature carbonization offers many features of promise for relief

of the increasing shortage of clean, solid fuel for domestic use, for mitigation of the smoke nuisance from bituminous coal, and for the making of valuable by-products, but he called attention to some serious practical difficulties in the method of operation. Four processes now under active industrial experimentation in America were described. Doctor Porter's paper has since been published in the March, 1925, issue of the JOURNAL. At this meeting the new by-laws were unanimously adopted, and the nominations for the annual election of officers were made. The Howard N. Potts Medal was presented to Dr. John A. Anderson, of the Mount Wilson Solar Observatory, California, for his improvements in the ruling of gratings and for the invention of a new form of seismograph.

January 21, 1925: Mr. W. N. Jennings, a member of the Institute, addressed the meeting on "Rapid-fire Photography." He described numerous journeys which he had taken to various parts of the world to obtain photographs illustrating special features of the countries and their inhabitants. He also gave an account of his airplane journeys for the purpose of taking bird's-eye-view pictures of industrial establishments, estates, etc., and described his hasty trip by airplane to Lakehurst, N. J., that he might photograph the ZR-3 (Los Angeles) on its arrival in this country. The subject was illustrated by more than one hundred lantern slides from original photographs. At this meeting the resolution of the Board of Managers recommending the election to Honorary Membership of the Honorable William Cameron Sproul, Ex-Governor of the State of Pennsylvania, was unanimously adopted, and the President presented his Annual Report of the activities of the Institute during the year ending September 30, 1924.

February 18, 1925: Mr. Leon S. Moisseiff, C.E., Engineer of Design, the Delaware River Bridge Joint Commission, spoke on "The Towers, Cables and Stiffening Trusses of the Bridge over the Delaware River between Philadelphia and Camden," and Mr. Clement E. Chase, C.E., Principal Assistant Engineer, the Delaware River Bridge Joint Commission, spoke on "Research and Experimental Tests in Connection with the Design of the Bridge over the Delaware River between Philadelphia and Camden." This meeting was a joint one with the Engineers' Club of Philadelphia and the Philadelphia Section of the American Society of Civil Engineers. Mr. Moisseiff's paper was devoted to a consideration of the conditions governing the design of the bridge, requirements of navigation, development of traffic over the bridge, and materials available. The type of the structure and its aesthetic appearance were also considered, special reference being made to the design of the towers. Cables, their anchoring, saddles and suspension, and the stiffening trusses, their function and behavior were discussed, and mention was made of the evolution of the stiffening truss theories and the deflection theory, its meaning and economic value. Mr. Chase's communication described the tests made for the purpose of determining the best proportions and probable strength of the compression members composing the main towers, and discussed the experiments made with the single cable wires to show their strength under various conditions of combined loading and reduced area, and to demonstrate the efficiency of splices. Mention was also made of the wire rope and parallel wire strands

which were tested in units of varying size to ascertain strength and efficiency. Model cable sections were compacted in order to predict size of finished cable, and full-size tests were made to investigate secondary stresses induced by bending and the resistance of the cable bands against sliding. Both papers were illustrated by lantern slides. At this meeting the Louis E. Levy Medal was presented to Dr. Harvey C. Hayes for his paper on "Measuring Ocean Depths by Acoustical Methods," which appeared in the March, 1924, issue of the JOURNAL.

March 18, 1925: E. G. Zies, Ph.D., Geophysical Laboratory, Carnegie Institution of Washington, presented a paper, which was illustrated by a series of colored lantern slides, on "Volcanic Incrustation in the Valley of Ten Thousand Smokes." He gave a brief account of the fumarolic area in the volcanic region of Alaska called the Valley of Ten Thousand Smokes, and described the general characteristics of the incrustations and the probable method by which the various constituents were transported and concentrated. He also referred to the mineralogical changes that are liable to take place with the lowering of temperature. At this meeting the resolution of the Board of Managers recommending the election to Honorary Membership of Professor Pieter Zeeman, of Amsterdam, Holland, and Dr. Elihu Thomson of Swampscott, Mass., was unanimously adopted. The Edward Longstreth Medal was presented to Major William E. Hoke, of Washington, D. C., for his improved method of making and measuring precision gauges. The Edward Longstreth Medal was also presented at this time to Mr. Daniel H. Meloche, of Detroit, Mich., for his method of making long-life molds and their application in the quantity production of castings.

April 15, 1925: Harry N. Holmes, Ph.D., Chairman, Committee on Chemistry of Colloids, National Research Council, presented a paper on "Silica Gels," in which he described the evolution of the process of the preparation of silicic acid and its application for the selective adsorption from mixtures of vapors or gases. He referred to the method of Patrick for drying silicic acid and his special heat treatment for the preparation of a gel, and gave an account of his own investigations in this field and the more porous silica gel which he and some of his assistants have recently been able to prepare. The speaker pointed out that the use of these various forms of silica gel must include solvent recovery, drying of air for the blast furnace, and for the vacuum ice process, recovery of sulphur dioxide and oxides of nitrogen, removal of offensive odors from air, removal of sulphur compounds from petroleum fractions, decolorizing certain liquids, recovery of gasoline from natural gas and many other uses. His subject was illustrated by experiments and diagrams. The Elliott Cresson Medal was presented at this meeting to Mr. Francis Hodgkinson, of Swarthmore, Penna., for his work on turbo-electric appliances, and the Edward Longstreth Medal was presented to Mr. Thomas M. Chance, of Philadelphia, for his method and apparatus for the separation of materials of different specific gravities.

May 20, 1925: Dr. William C. L. Eglin, President, in the chair, announced the business of the meeting would be the annual presentation of the Franklin Medal in recognition of distinguished scientific and technical achievements. He

recognized Dr. Karl T. Compton, of Princeton University, who made a statement relative to the work of Dr. Pieter Zeeman, of the University of Amsterdam, recently awarded the Franklin Medal, "in recognition of his numerous and important contributions in the field of magneto-optics and particularly of his discovery of the effect of a magnetic field upon the frequencies of the light from a radiating source." Mr. A. Loudon, Secretary, Royal Netherland Legation, Washington, D. C., representing the Netherland Minister, Jonkheer Dr. de Graeff, was then presented to the Chairman and received from him the Franklin Medal, accompanying certificate, and Certificate of Honorary Membership in the Institute, awarded to Doctor Zeeman, and expressed appreciation of the high honor conferred upon his distinguished countryman. Dr. E. W. Rice, Jr., General Electric Company, was then recognized and described the work of Dr. Elihu Thomson, of Lynn, Mass., who had been awarded the Franklin Medal "in recognition of his pioneer work in the field of electricity and electrical engineering and of his numerous inventions in these fields." Doctor Thomson was then presented to the Chairman and received from him the Franklin Medal, accompanying certificate, and Certificate of Honorary Membership in the Institute, whereupon he expressed his thanks for the honor conferred upon him. Dr. Arthur W. Goodspeed, of the Institute's Board of Managers, was then recognized, and introduced to the Chairman the Honorable William Cameron Sproul, Ex-Governor of Pennsylvania, who had been elected to Honorary Membership in the Institute. The Chairman presented the Certificate of Honorary Membership to Doctor Sproul, who expressed his appreciation of this recognition. Doctor Compton then read the paper prepared by Doctor Zeeman for the occasion on the "Magnetization of Spectrum Lines," after which Doctor Thomson presented his paper on "The Mechanical, Thermal and Optical Properties of Fused Silica."

Nine other meetings with a total attendance of 896 were held during the year in the hall of the Institute. The following is a list of dates and speakers with titles and synopses of their communications:

October 30, 1924: Mr. Hans Weichsel, The Wagner Electric Corporation, St. Louis, Mo., presented a paper, which has since been published in the May, 1925, issue of the JOURNAL, on "The Fynn-Weichsel Motor—A Power-factor Corrective for Alternating-current Distribution Systems." The alternating-current distribution systems usually operate with poor power-factor, resulting in excessive current draw. Machines with leading power-factor, such as the Fynn-Weichsel motor, correct this condition. Mr. Weichsel explained the construction, theory, and performance of this motor, and gave descriptions and illustrations of installations reducing their current by this method. His paper was subdivided into the following main subjects:

- (1) The definition of "power-factor"—its causes and effects.
- (2) Improving the power-factor of a system by aid of motors with leading power-factor.
- (3) The mechanical and electrical constructive features of the Fynn-Weichsel motor—a motor with leading power-factor.
- (4) Theory of the Fynn-Weichsel motor.
- (5) Performance tests under normal and abnormal conditions.
- (6) Descriptions of actual installations.

December 4, 1924: Mr. Francis F. Lucas, Research Laboratories, American Telephone and Telegraph Company, and Western Electric Company, Inc., presented a paper on "High-power Metallography—Some Recent Developments in Photomicrography and Metallurgical Research." In this paper Mr. Lucas described briefly the Bell System Laboratory for technical microscopy and discussed the equipment and optical parts used in high-power metallography. He also discussed the technique by which brilliant and crisp images are obtained, showing remarkable resolution and depth of penetration at high magnifications. The illustrations of this paper showed many new and heretofore unresolved details of metal structures, and it is felt that the practical application of this new information should lead to a better understanding of metals.

January 8, 1925: Professor F. G. Cottrell, Ph.D., Director, Fixed Nitrogen Research Laboratory, United States Department of Agriculture, Washington, D. C., spoke on "The Future of Nitrogen Fixation." He said that the enormous consumption of electrical energy in the initial or arc process for nitrogen fixation made it dependent upon cheap water power. The later trend has been toward processes requiring less and less electric power and making more and more use of coal and its products as chemical reagents. Further promising development is plainly in sight along these lines, while beyond, distinctly new possibilities and avenues of approach are already faintly emerging from the haze.

January 29, 1925: Wilder D. Bancroft, Ph.D., Sc.D., Cornell University, Ithaca, N. Y., presented a paper on "Metallic Luster." He said that we get the sensation of metallic luster from metals, opaque crystals such as pyrites or stibnite, from transparent crystals such as methyl orange, from total reflection, from selective reflection with crystals of magenta, from exfoliated mica, from oil films, from the throat feathers of the humming bird and the breast feathers of the peacock, from moonlight on the water, and from the stereoscopic combination of differently colored images; and he showed that the problem is to find what characteristics are common to all of these cases.

March 5, 1925: Professor Robert H. Fernald, Director Mechanical Engineering, Towne Scientific School, University of Pennsylvania, presented a communication on "Fuel Conservation: Fact or Fancy." He discussed the basic causes of our fuel wastes and extravagances, and then took up the subject from the standpoint of the three general classes of fuel: Solid, liquid and gaseous. Under the first subdivision, he spoke of the present uses of coal, and contrasted the reasonable savings that might be made and the extravagances of to-day. Special emphasis was placed upon the use of coal at the mines, by the railroads, by the industries, in domestic plants, in coke making, in coal gas manufacture and on steamships. In a similar way, our original petroleum resources were outlined, and our alarming rate of consumption was stressed. There was some detailed discussion of the use of oil by industrial and stationary plants, merchant marine and navy, and the railways. Then the question was taken up of the supply of gasoline and of the use of substitutes, and the future possibilities of oil from shales was considered. Next was pictured the abominable waste of our natural gas supply and the straits to which we are now put to find substitutes for this material. Dr. Fernald concluded his paper by pointing out definite steps that should be followed by engineers and scientists

toward a consistent checking of the ruthless waste of our fuel resources and toward a much needed conservation program.

March 12, 1925: Professor W. F. G. Swann, Sloane Physical Laboratory, Yale University, New Haven, Conn., presented a paper on "The Principle of Relativity," containing an account of the ideas which have led up to the formulation of both the restricted and general theories. An attempt was made to illustrate the practical uses of relativity in theoretical physics, and an account was given of its predictions as to planetary motion, the bending of light rays by the sun, and the effect of the sun's gravitational field on the light emitted.

March 26, 1925: Mr. Stanwood W. Sparrow, Bureau of Standards, Washington, D. C., spoke on "Aviation Engine Performance," discussing the factors which influence the performance of an aviation engine. The subject was confined to performance as judged by power and fuel consumption, showing how these are affected by volumetric efficiency, mechanical efficiency, fuel-air ratio, compression ratio, etc. The speaker directed attention to the effect of atmospheric pressure and temperature upon these quantities, having derived the information which he used for explanation and illustration from tests in the altitude laboratory of the Bureau of Standards.*

April 2, 1925: General William Barclay Parsons spoke on "Some Future Problems of Engineering," showing that the animating spirit of the nineteenth and twentieth centuries is energy, the demand for which is increasing on an ascending scale. He analyzed the exhaustion of fuel in the effort to furnish energy, and discussed the economics in present methods and the finding of new sources of energy. These constitute the great future problems of engineering. Can they be solved? If so, how? If not, what will be the result?

April 30, 1925: R. A. Millikan, Sc.D., Director, Norman Bridge Laboratory, California Institute of Technology, presented a paper on the "Astronomy of the Atom."

Respectfully submitted,

HOWARD McCLENAHAN,

Chairman.

PHILADELPHIA, January 13, 1926.

REPORT OF THE COMMITTEE ON MEMBERSHIP

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1925

To the Board of Managers of The Franklin Institute:

During the fiscal year ending September 30, 1925, one hundred and sixteen members were enrolled in all classes of membership; resignations were received and accepted from twelve members; and deaths of twelve members were recorded.

The detail as to elections, resignations, and deaths for the year is as follows:

ELECTIONS:

| | |
|----------------------------|----|
| Resident Members | 32 |
| Non-resident Members | 32 |
| Associate Members | 3 |

| | |
|---|-------|
| Honorary Members | 3 |
| Life Members | 2 |
| Contributing Members | 44 |
| | <hr/> |
| | 116 |
| RESIGNATIONS: | |
| Resident Members | 6 |
| Non-resident Members | 6 |
| | <hr/> |
| | 12 |
| DEATHS: | |
| Resident Members | 7 |
| Non-resident Members | 2 |
| Honorary Members | 1 |
| Second-class Stock Members | 2 |
| | <hr/> |
| | 12 |
| SUMMARY: | |
| Elections | 116 |
| Resignations | 12 |
| Dropped for non-payment of dues | 17 |
| Deaths | 12 |
| Net increase in membership | 75 |
| Membership of the Institute by Classes, September 30, 1925. | |
| Resident Members | 521 |
| Non-resident Members | 582 |
| Life Members | 193 |
| Honorary Members | 30 |
| Associate Members | 17 |
| Second-class Stock Members | 21 |
| Corresponding Members | 2 |
| Contributing Members | 44 |
| | <hr/> |
| Total | 1410 |

It is hoped that during the year 1926 much larger increases will be shown, in view of the fact that during 1925 there were created two new classes of membership, one Contributing Members, of which there were 44 elected in 1925, representing various industrial establishments in Philadelphia taking out this class of membership; and the other Student Membership for boys and young men, with very low dues, by means of which it is expected that interest in The Franklin Institute will be awakened in the schools and collegiate institutions in and around Philadelphia.

During the recent autumn, plans have been completed by a specially appointed Committee, and the Membership Committee, for continuing efforts to increase the membership of the Institute and to extend its usefulness. The Committees have prepared a circular letter to which are attached the names

of nineteen influential citizens of Philadelphia. The Committees have also prepared a circular which gives in readable form an outline of the history of the Institute, and shows what the Institute has done for the City and State. These documents have been printed in large numbers and will be used by all interested in the Institute in the efforts to increase the membership.

Respectfully submitted,

R. W. LESLEY,
Chairman.

PHILADELPHIA, January 13, 1926.

REPORT OF THE COMMITTEE ON FINANCE

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1925

To the Board of Managers of The Franklin Institute:

The Committee presents the following statement:

PROPERTY AND FUNDS

| | | | |
|--|----------------|------------|----------------|
| Building and Land, 13-17 South Seventh Street..... | \$60,000.00 | | |
| Library | 100,000.00 | | \$160,000.00 |
| | Principal. | Unexpended | |
| Funds held by Board of Trustees | \$648,822.65 | \$2,349.84 | |
| Funds held by Board of Managers..... | 176.20 | | |
| Franklin Institute Building Fund..... | 571,413.90 | | |
| Elliott Cresson Medal Fund | 3,000.00 | 1,149.16 | |
| Franklin Fund and Building Committee.... | 17,470.19 | | |
| | | | |
| Total Funds | \$1,240,882.94 | \$3,499.00 | \$1,244,381.94 |
| | | | |
| Grand Total | | | \$1,404,381.94 |

LIABILITIES

| | |
|-----------------------------|-------------|
| Certificates of Stock | \$28,794.00 |
| Bills Payable | 45,000.00 |
| Vouchers Payable | 2,554.19 |
| Unearned Income | 115.00 |
| | |
| | \$76,463.19 |

INCOME AND EXPENSES APPLICABLE TO THE YEAR ENDED SEPTEMBER 30, 1925

INCOME

| | | |
|---------------------------------|------------|-------------|
| Dues—Resident | \$7,612.50 | |
| Non-resident | 2,817.50 | |
| Second-class Stock | 252.00 | |
| Associate | 85.00 | |
| Contributing | 330.00 | \$11,097.00 |
| | | |
| Initiation Fees | | 170.00 |
| H. Belfield Memorial Fund | | 263.44 |

| | | |
|--|------------|-------------|
| James H. Cresson Memorial Fund | | \$2,291.16 |
| General Endowment Fund | | 18,676.54 |
| John H. Wahl Fund | | 4,359.29 |
| Lewis S. Ware Library Fund | | 600.00 |
| Estate of John Turner | | 167.24 |
| Estate of Robert Wright | | 2,164.76 |
| Augene P. Rogers Donation acct. | | 1,756.26 |
| Publications—Subscriptions and Sales | \$4,194.18 | |
| Advertising | 5,403.80 | 9,597.98 |
| | | <hr/> |
| “Physics of the Air” | | 250.00 |
| Miscellaneous Income and Expense | | 74.28 |
| | | <hr/> |
| Total | | \$51,467.95 |

EXPENSES

| | | |
|--|-------------|-------------|
| Building—Wages | \$1,061.46 | |
| Repairs and Maintenance | 492.86 | |
| Taxes, Water Rent and Insurance | 102.28 | |
| Heat, Light and Power | 772.63 | |
| Miscellaneous Supplies and Expense | 389.88 | \$3,719.11 |
| | | <hr/> |
| Instruction—Salaries and Annuities | | 250.00 |
| Library—Salaries | \$10,062.50 | |
| Books and Periodicals | 2,029.82 | |
| Binding | 984.80 | |
| Miscellaneous Expense | 144.94 | 13,222.06 |
| | | <hr/> |
| Meetings | | 2,943.62 |
| Office and General—Salaries | \$14,164.63 | |
| Office Expense | 1,391.62 | |
| General Expense | 1,354.06 | |
| Auditor and Treasurer | 300.00 | \$17,210.31 |
| | | <hr/> |
| Publications—Printing | \$13,675.90 | |
| Illustrating | 3,380.53 | |
| Miscellaneous Expense | 756.80 | |
| Year Book | 1,166.69 | |
| Reprints | 825.63 | 19,805.55 |
| | | <hr/> |
| Science and Arts | | 2,643.67 |
| Interest and Discount | | 2,108.20 |
| Badges and Certificates | | 177.70 |
| | | <hr/> |
| Total | | \$62,080.22 |
| | | <hr/> |
| Deficit | | \$10,612.27 |

Though the above shows an operating deficit of \$10,612.27, the excess of assets over liabilities is \$31,391.22 greater this year than last, and, therefore the figures show a definite financial gain.

Respectfully submitted,

WALTON FORSTALL,
Chairman.

PHILADELPHIA, January 13, 1926.

REPORT OF THE COMMITTEE ON PUBLICATIONS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1925

To the Board of Managers of The Franklin Institute:

The December number of the JOURNAL OF THE FRANKLIN INSTITUTE completes the two hundredth volume of the JOURNAL, and one hundred years of uninterrupted publication of that periodical. This is an almost unique record. No other case of such a protracted and uninterrupted period of publication of a journal of similar purpose is known to the members of your Committee. In the January number, which is the first number of the two hundred and first volume, the editors note this happy record and comment upon the changes of purposes and of form of the JOURNAL. The establishment of active research work at the Bartol Foundation puts upon the JOURNAL a necessity for use of many of its pages for reporting research, without relieving it of the duty of reporting upon matters of general interest in science and upon inventions. The JOURNAL must continue to publish matters of general interest, at the same time that it gives in detail the reports of research work.

During the past year the Committee has held its usual monthly meetings, at which all matters pertaining to the functions of the Committee have been dealt with.

During that period one hundred and seventy-six copies of Doctor Humphreys' "Physics of the Air" were sold, leaving on hand eighty-two copies.

Also, during the same time, one hundred and forty-two copies of Dr. J. J. Thomson's "The Electron in Chemistry" have been sold, leaving on hand one hundred and forty-four copies.

A statement of the financial operations of the Committee for the year follows:

| JOURNAL: | EXPENSES | |
|----------------------|-------------|-------------|
| Printing | \$13,675.90 | |
| Illustrations | 3,380.53 | |
| Miscellaneous | 756.80 | |
| Year Book | 1,345.69 | |
| Reprints | 1,664.69 | |
| | <hr/> | |
| Total Expenses | | \$20,823.61 |

| JOURNAL: | INCOME | |
|---------------------|------------|--|
| Subscriptions | \$4,194.18 | |
| Advertising | 5,403.80 | |

Year Book:

| | |
|-------------------|----------|
| Advertising | \$179.00 |
| Reprints: | |
| Sales | 839.06 |

Total Income \$10,616.04

Net Cost \$10,207.57

This figure of \$10,207.57 takes no account of the part of the subscriptions of the members which should be allotted to the JOURNAL for those numbers of the JOURNAL which are sent without charge to all members of the Institute.

Respectfully submitted,

E. H. SANBORN,
Chairman.

PHILADELPHIA, January 13, 1926.

REPORT OF COMMITTEE ON ENDOWMENT

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1925

To the Board of Managers of The Franklin Institute:

Your Committee on Endowment begs to report that the only endowment received during the fiscal year ending September 30, 1925, was one from John Henry Towne, same to be known as the John Henry Towne Memorial Fund; amount \$10,000. This Endowment Fund is without restriction as to use.

Respectfully submitted,

G. H. CLAMER,
Chairman.

PHILADELPHIA, January 13, 1926.

REPORT OF THE COMMITTEE ON SCIENCE AND THE ARTS

FOR THE FISCAL YEAR ENDING JANUARY 31, 1926

To the President and Members of The Franklin Institute:

The year 1925 marked the ninety-first year of the existence of the Committee on Science and the Arts. During the period covered by this report investigations and final disposition were made of eighteen cases and thirteen are now pending. In the appendix to this report will be found the name of the inventor and of the invention and the award made in each case.

In fourteen of the eighteen cases investigated awards were made, one case was tabled on account of legal complications and one on account of the death of the inventor. After investigation two cases were dismissed without prejudice.

The Standing Committee on Literature and the Franklin Medal held their customary meetings and recommended the award of two Franklin Medals and one Levy Medal. Detailed statements of these awards are given under the head of The Franklin Institute Awards.

The Sub-committee on New Subjects and Preliminary Examination held nine stated meetings during the year and considered fifty-two subjects. Applications were received covering ten of these subjects and five special cases were

accepted for investigation for which no applications were required and Sub-committees of investigation were appointed.

The meetings of this Sub-committee were well attended and careful consideration was given to the subjects presented.

According to custom, the awards to recipients who could be personally present at the Stated Meetings of the Institute were presented by the President of the Institute.

Mr. A. Loudon, Secretary of the Netherland Legation, was present to receive the Franklin Medal awarded to Professor Pieter Zeeman, of Amsterdam, Holland; Professor Elihu Thomosn, of Lynn, Mass., to receive the Franklin Medal awarded to him; Dr. Harvey C. Hayes, of Washington, D. C., to receive the Louis Edward Levy Medal, Mr. Francis Hodgkinson, of Swarthmore, Penna., to receive the Elliott Cresson Medal; Mr. Thomas M. Chance, of Philadelphia, Penna., Mr. Daniel H. Meloche, of Detroit, Mich., and Mr. Thomas Midgley, Jr., of Dayton, Ohio, to receive Edward Longstreth Medals. Medals for other recipients who were too far away to permit attendance at the Stated Meetings were mailed to them.

On December 18, 1925, the Committee on Science and the Arts lost by death, Mr. J. Y. McConnell, who for twenty-seven years has been an active and efficient member of its Committee.

Nineteen of the twenty members whose term expired January, 1925, were reëlected. The following new members were elected:

MR. WILLIAM G. ELLIS
MR. JAMES LOGAN FITTS
MR. FREDERIC V. HETZEL
MR. COLEMAN SELLERS, 3RD
MR. WALTER C. WAGNER.

During the year the family of John Price Wetherill transmitted to the Institute a certain sum of money for the establishment of a fund to provide a medal to be known as the John Price Wetherill Medal. The conditions under which this medal is to be awarded are as follows:

"Awarded for discovery or invention in the physical sciences, or for new and important combinations of principles or methods already known."

On the obverse of the medal the inscription will be:

JOHN PRICE WETHERILL MEDAL, 1925

And on the reverse

Awarded by
The Franklin Institute
to

for Discovery, Invention
or
Development
in
Physical Science.

YEAR BOOK OF

The two features which mark the past year of the Committee on Science and the Arts are, first, the establishment of a new medal and, second, the extraordinary attendance at the meetings.

The Wetherill Medal, as already described, fills a need that has long been felt by the Committee. It has been difficult in the past to equitably award the two medals available—the Cresson and the Longstreth—over a wide range of subjects of varying importance. The addition of the Wetherill Medal permits the Cresson to be used for major discoveries or inventions while this new medal can be used for improvements or developments of a grade higher than those for which the Longstreth has been allotted.

The past year has also been notable for the large attendance at the meetings. Moreover this has been entirely spontaneous, no effort having been made to boost the attendance. While this has been gratifying, it is a fact that there are members on the Committee who but rarely, if ever, attend. These members may be individually valuable but their services cannot be fully realized unless they attend the regular meetings of the General Committee. It is hoped that the succeeding years will see a greater attendance of these members.

The dinners which precede the meetings, while not officially a part of the activities of the Committee on Science and the Arts, have also been unusually well attended. These dinners give the members a better opportunity to become acquainted and add to the personal interest of those serving together on the Sub-committees.

There have not been as many subjects submitted to the Committee for consideration as in some previous years and the Committee would welcome additional suggestions from any source.

The subjects under consideration for awards frequently involve highly technical points, and discussions are generally limited to those members having that knowledge. This year the discussions have been unusually interesting and sharp but without any tinge of acrimony.

The Chairman desires to thank those members who have served on the various sub-committees for work well done and also all those who have attended the general Committee meetings for their interest and support and bespeaks the same interest and attendance for his successor.

A detailed statement of the Committee's work during the period which this report covers is appended.

Respectfully submitted,

HAROLD CALVERT,
Chairman.

PHILADELPHIA, January 31, 1926.

APPENDIX

Statement of the Committee's Operation from January 31, 1925, to January 31, 1926

| | |
|--|----------|
| Cases pending February 1, 1925 | 17 |
| Applications received to January 31, 1926..... | 10 |
| Special reports | 4 |
| | <hr/> 31 |
| Disposed of to January 31, 1926 | 18 |
| Leaving pending | 13 |

AWARDS MADE

| | |
|--------------------------------------|-------|
| Franklin Medal Awards | 2 |
| Louis Edward Levy Awards | 1 |
| Elliott Cresson Awards | 1 |
| Howard N. Potts Awards | 1 |
| John Price Wetherill Awards | 2 |
| Edward Longstreth Medal Awards | 4 |
| Certificate of Merit Awards | 3 |
| | <hr/> |
| | 14 |

REPORT OF THE COMMITTEE ON BARTOL RESEARCH FOUNDATION

FOR THE FISCAL YEAR ENDING DECEMBER 31, 1925

To the President and Members of The Franklin Institute:

During the fiscal year, just ended, considerable progress has been made in getting under way the work of the Bartol Foundation. While a Director has not yet been appointed, research work of a fundamental nature dealing with problems in electricity is being carried out under the direct supervision of Dr. W. F. G. Swann, of the Sloane Laboratory, Yale University, and Prof. E. P. Adams, of Princeton University, these two gentlemen being members of an Advisory Committee appointed to direct the scientific activities of the Foundation until a Director is chosen.

One Fellow, Dr. Arthur Bramley, recently of Princeton University, has been appointed and is now engaged at the Foundation Laboratories. Additional Fellows are under consideration, several of whom will probably be appointed as soon as they can be released from the work upon which they are now engaged in other scientific institutions.

In addition, special investigations are being carried out at the Foundation by Professors Swann and Adams through their personal assistants. During the summer Doctor Swann conducted an experiment in Sweden with the idea of securing evidence of a Corpuscular Radiation of Cosmic Origin. The results of this investigation will be published in the JOURNAL OF THE FRANKLIN INSTITUTE as a contribution from the Bartol Research Foundation. The apparatus used by Doctor Swann was made in the machine shops of the Foundation.

A glass blower has been engaged and a shop and laboratories are now fully equipped and prepared to construct and assemble any apparatus likely to be needed in connection with problems now under consideration.

The Personnel Committee consisting of Doctor Swann, Dean Jos. S. Ames, of the Johns Hopkins University, and Dr. Arthur L. Day, of the Geophysical Laboratory, Washington, is making a careful survey of the field with the idea of securing eight or ten Fellows and also a Director, who will be appointed as soon as a suitable man can be found for the position.

The routine work of the Foundation is being efficiently taken care of by the staff of The Franklin Institute under the able direction of the Secretary, Dr. Howard McClenahan.

While progress in getting the work of the Foundation under way has necessarily been slow, it is now proceeding at a rate which, it is thought, justifies the statement that it will be in full operation during the present year. In the meanwhile, as will be seen from the financial statement included in the Report of the Committee on Finance, a very considerable sum has been added to the principal account.

Respectfully submitted,

PHILADELPHIA, January 13, 1926.

C. C. TUTWEILER,
Chairman.

THE FRANKLIN INSTITUTE AWARDS

FEBRUARY 1, 1925, TO JANUARY 31, 1926

THE FRANKLIN MEDAL

TO

Dr. Elihu Thomson, of Lynn, Mass., "in recognition of his pioneer work in the field of electricity and electrical engineering and of his numerous inventions in these fields."

Professor Pieter Zeeman, of Amsterdam, Holland, "in recognition of his numerous and important contributions in the field of magneto-optics and particularly of his discovery of the effect of a magnetic field upon the frequencies of the light from a radiating source."

THE ELLIOTT CRESSON MEDAL

TO

Mr. Francis Hodgkinson, of Swarthmore, Penna., in recognition of his work in Turbo-electric Appliances.

THE LOUIS EDWARD LEVY MEDAL

TO

Dr. Harvey C. Hayes, of Bellevue, Anacostia, D. C., for his paper entitled "Measuring Ocean Depths by Acoustical Methods" in the JOURNAL.

THE HOWARD N. POTTS MEDAL

TO

Professor C. T. R. Wilson, of Cambridge, England, for his Discovery of a Method of Making the Tracks of Ionizing Rays Visible and Capable of Permanent Record by Photography.

THE JOHN PRICE WETHERILL MEDAL

TO

Mr. Frank Twyman, of London, England, for his inventions embodied in the Hilger Interferometer.

Wagner Electric Corporation, of Saint Louis, Mo., with special mention of Mr. Val A. Fynn and Mr. H. Weichsel, for the Fynn-Weichsel Motor.

THE EDWARD LONGSTRETH MEDAL

TO

Major William E. Hoke, of Washington, D. C., for his inventions embodied in the Hoke Precision Gauge Blocks.

Mr. Thomas M. Chance, of Philadelphia, Penna., for his inventions embodied in the Chance Method and Apparatus for Separating Materials of Different Specific Gravities.

Mr. Daniel H. Meloche, of Detroit, Mich., for his Long Life Molds.

Mr. Thomas Midgley, Jr., of Dayton, Ohio, for his inventions embodied in the Midgley Optical Indicator.

CERTIFICATE OF MERIT

TO

Mr. B. Denver Copping, of Wilmington, Del., for his inventions embodied in the Plastometer.

Mr. Charles B. Gray, of Buffalo, N. Y., for his inventions embodied in the Gray Sheet Metal Cutter.

Mr. Theodore C. and Mr. Willis O. Prouty, of Hermosa Beach, Calif., for their inventions embodied in the Van Sicklen-Elgin Chronometric Tachometer.

AWARDS

1835-1926

FRANKLIN MEDAL AWARDS

1915-1926

ARRHENIUS, SVANTE AUGUST, PH.D., M.D., D.Sc., LL.D.

"In recognition of his notable contributions to the theory of physical science which have found unprecedently extended and fruitful application in the experimental study of chemical, physical, biological and cosmic phenomena, as well as in industrial chemistry."

1920.

CARTY, JOHN J., D.ENG., D.Sc., LL.D., D.S.M.

"In recognition of his long-continued activities in the telephone service, his important and varied contributions to the telephone art, his work in the establishment of the principles of telephone engineering, and his signal success in directing the efforts of a large staff of engineers and scientists to the accomplishment of the telephonic transmission of speech over vast distances."

1916.

DEWAR, SIR JAMES, LL.D., D.Sc., PH.D., F.R.S.E., F.I.C., F.C.S.

"In recognition of his numerous and most important contributions to our knowledge of physical and chemical phenomena and his great skill and inventive genius in attacking and solving chemical and physical problems of the first magnitude."

1919.

EDISON, THOMAS ALVA, PH.D., D.Sc., LL.D.

"In recognition of the value of numerous basic inventions and discoveries forming the foundation of world-wide industries, signally contributing to the well-being, comfort and pleasure of the human race."

1915.

FABRY, CHARLES, D.Sc.

"In recognition of his numerous and highly important contributions in the field of physical science, particularly the solution of optical and spectroscopical problems of fundamental importance."

1921.

FERRIÉ, AUGUSTE GUSTAVE, GENERAL.

"In recognition of his long-continued and successful researches in the field of radio-transmission of intelligence and their splendid and successful military applications, and of his eminent success in the organization

FRANKLIN MEDAL AWARDS

and directing of the communication service of the French Army during the World War."

1923.

LORENTZ, HENDRICK ANTOON, PH.D., F.R.S.

"In recognition of his researches which have so largely contributed to laying on a new foundation our knowledge of the nature of light and in developing our ideas concerning the ultimate constitution of matter."

1917.

MARCONI, GUGLIELMO, LL.D., D.Sc.

"In recognition of his brilliant inception and successful development of the application of magneto-electric waves to the transmission of signals and telegrams without the use of metallic conductors."

1918.

MENDENHALL, THOMAS CORWIN, PH.D., D.Sc., LL.D., F.A.G.S.

"In recognition of his fruitful and indefatigable labors in physical research, particularly his contributions to our knowledge of physical constants and electrical standards."

1918.

MICHELSON, ALBERT A., PH.D., Sc.D., LL.D.

"In recognition of his numerous and signally fruitful researches in physical science, especially his brilliant discoveries in the fields of optics and astrophysics."

1923.

MODJESKI, RALPH, D.ENG.

"In recognition of his signal achievements as a designer and a builder of structures, mainly bridges, many of them epoch-marking in the history of the engineering profession, beautiful as well as useful, involving on the part of the designer, vision, courage and technique of the highest order."

1922.

ONNES, HEIKE KAMERLINGH, PH.D., D.Sc.

"In recognition of his long-continued and indefatigable labors in low-temperature research, which have enriched physical science, not only with a great number of new methods and ingenious devices, but also with achievements and discoveries of the first magnitude."

1915.

PARSONS, SIR CHARLES ALGERNON, K.C.B., C.B., M.A., LL.D., D.Sc., F.R.S.

"In recognition of his epoch-marking success in the development of the steam turbine, which has revolutionized the art of steam engineering, particularly in regard to the propulsion of mercantile and naval vessels and the driving of electrical generators."

1920.

FRANKLIN MEDAL AWARDS

RICHARDS, THEODORE WM., A.M., PH.D., Sc.D., LL.D., CHEM.D., M.D., F.C.S.

"In recognition of his numerous and important contributions to inorganic, physical and theoretical chemistry, and particularly his classical series of redeterminations of the atomic weights of the more important chemical elements."

1916.

RUTHERFORD, SIR ERNEST, KT., D.Sc., LL.D., PH.D., D.PHYS., F.R.S.

"In recognition of long-continued and fruitful researches, signally contributing to the present state of knowledge of the elements, their constitution and relationships."

1924.

SPRAGUE, FRANK J., D.ENG.

"In recognition of his many and fundamentally important inventions and achievements in the field of electrical engineering, notably his contributions to the development of the electric motor and its application to industrial purposes, and in the art of electric traction, signally important in forming the basis of world-wide industries and promoting human welfare."

1921.

SQUIER, GEORGE OWEN, K.C.M.G., D.S.M., PH.D.

"In recognition of his valuable contributions to physical science, his important and varied inventions in multiplex telephony and telegraphy and in ocean cabling and his eminent success in organizing and directing the air and signal services of the U. S. Army in the World War."

1919.

TAYLOR, DAVID WATSON, D.ENG., D.S.M.

"In recognition of his fundamental contributions to the theory of ship resistance and screw propulsion and of his signal success in the application of correct theory to the practical design of varied type of war vessels in the U. S. Navy."

1917.

THOMSON, ELIHU, PH.D., Sc.D., LL.D.

"In recognition of his pioneer work in the field of electricity and electrical engineering and of his numerous inventions in these fields."

1925.

THOMSON, SIR JOSEPH JOHN, O.M., F.R.S., D.Sc., F.R.S.E., LL.D., PH.D.

"In recognition of the immeasurable service he has rendered to the world as teacher and leader of thought in that domain of science, especially related to a fundamental knowledge of electricity and the constitution of matter."

1922.

WESTON, EDWARD, LL.D., Sc.D.

"In recognition of discoveries and inventions in the field of electricity,

FRANKLIN MEDAL AWARDS

immeasurably fruitful and fundamentally contributory to the establishment of the electric art."

1924.

ZEBMAN, PIETER, PH.D., SC.D.

"In recognition of his numerous and important contributions in the field of magneto-optics and particularly of his discovery of the effect of a magnetic field upon the frequencies of the light from a radiating source."

1925.

CRESSON MEDAL AWARDS

1856-1926

ACKER, C. E.

Process of Manufacturing Caustic, etc.—1902.

ALBERT, CHARLES F.

Violins and Bows.—1887.

AMERICAN COTTON COMPANY.

Round Lap Bale System.—1901.

AMERICAN PAPER BOTTLE COMPANY.

Paper Bottles for Various Purposes.—1906.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY.

Contributions to the Modern Telephone Art.—1916.

ATWATER, W. O., and ROSA, E. B.

Respiration Calorimeter.—1900.

AUTOMATIC ELECTRIC COMPANY.

Automatic Telephony.—1910.

BAEYER, J. F. A. VON.

Research Work in Organic Chemistry.—1912.

BALDWIN LOCOMOTIVE WORKS.

Contributions to the Evolution of the American Locomotive.—1907.

BATCHELLER, C. H.

Compound Locomotive.—1893.

BATES, STOCKTON; SHAW, EDWIN, and VON CULIN, G. M.

Spindle Support.—1891.

BELL, ALEXANDER GRAHAM.

Electrical Transmission of Speech.—1912.

BERLINER, EMILE.

Telephony and Sound Reproduction.—1913.

BEVINGTON, J. H.

Welding Metal and Spinning and Shaping Tools.—1891.

BILGRAM, HUGO.

Bevel Gear Cutter.—1887.

BONWILL, W. G. A.

Electro-magnetic Dental Mallet.—1876.

BORSCH, LOUIS.

Solid Invisible Bifocal Lens.—1907.

CRESSON MEDAL AWARDS

BOWER, HENRY.

Inodorous Glycerine.—1878.

BRASHEAR, JOHN A.

Leading Work in Astronomic Science.—1910.

CASTNER, H. Y.

Electrolytic Process of Decomposing Alkaline Chlorides for the Production of Caustic and Chlorine.—1897.

CHABOT, CYPRIEN.

Shoe Sewing Machine.—1885.

CHAMBERS BROTHERS.

Bolt and Rivet Clipper.—1878.

CHARLTON, J.

Shaft Coupling.—1876.

CLAMER, G. H.

Methods of Eliminating Metals from Mixture of Metals.—1904.

COOPER-HEWITT, P.

Mercury Rectifier.—1910.

CORSCADEN, T.

All-wrought Steel Belt Pulley.—1898.

COWLES, EUGENE H. AND ALFRED H.

Electric Smelting Furnace.—1887.

COWPER, EDWARD A., AND ROBERTSON, T. HART.

Writing Telegraph.—1889.

CROOKES, SIR WILLIAM.

Discoveries in Chemistry.—1912.

CURIE, PIERRE AND MARIE.

Researches Resulting in the Discovery of Radium.—1909.

DEFOREST, LEE.

The Audion.—1922.

DELANDTSHERE, NORBERT.

Machine for Treating Flax.—1879.

DELANY, P. B.

Synchronous Multiplex Telegraphy.—1886.

DELANY, P. B.

System of Machine Telegraphy.—1896.

DELANY, P. B.

Telepost.—1908.

DIESEL, R.

Diesel Motor.—1901.

DODGE, J. M.

System of Storing Coal.—1904.

DUDLEY, P. H.

Dynamograph.—1877.

EDER, J. MARIA.

Researches in Photochemistry.—1914.

The two features which mark the past year of the Committee on Science and the Arts are, first, the establishment of a new medal and, second, the record-breaking attendance at the meetings.

The Wetherill Medal, as already described, fills a need that has long been felt by the Committee. It has been difficult in the past to equitably award the two medals available—the Cresson and the Longstreth—over a wide range of subjects of varying importance. The addition of the Wetherill Medal permits the Cresson to be used for major discoveries or inventions while this new medal can be used for improvements or developments of a grade higher than those for which the Longstreth has been allotted.

The past year has also been notable for the large attendance at the meetings. Moreover this has been entirely spontaneous, no effort having been made to boost the attendance. While this has been gratifying, it is a fact that there are members on the Committee who but rarely, if ever, attend. These members may be individually valuable but their services cannot be fully realized unless they attend the regular meetings of the General Committee. It is hoped that the succeeding years will see a greater attendance of these members.

The dinners which precede the meetings, while not officially a part of the activities of the Committee on Science and the Arts, have also been unusually well attended. These dinners give the members a better opportunity to become acquainted and add to the personal interest of those serving together on the Sub-committees.

There have not been as many subjects submitted to the Committee for consideration as in some previous years and the Committee would welcome additional suggestions from any source.

The subjects under consideration for awards frequently involve highly technical points, and discussions are generally limited to those members having that knowledge. This year the discussions have been unusually interesting and sharp but without any tinge of acrimony.

The Chairman desires to thank those members who have served on the various sub-committees for work well done and also all those who have attended the general Committee meetings for their interest and support and bespeaks the same interest and attendance for his successor.

A detailed statement of the Committee's work during the period which this report covers is appended.

Respectfully submitted,

HAROLD CALVERT,
Chairman.

PHILADELPHIA, January 31, 1926.

APPENDIX

Statement of the Committee's Operation from January 31, 1925, to January 31, 1926

| | |
|--|----------|
| Cases pending February 1, 1925 | 17 |
| Applications received to January 31, 1926..... | 10 |
| Special reports | 4 |
| | <hr/> 31 |
| Disposed of to January 31, 1926 | 18 |
| Leaving pending | 13 |

AWARDS MADE

| | |
|--------------------------------------|----|
| Franklin Medal Awards | 2 |
| Louis Edward Levy Awards | 1 |
| Elliott Cresson Awards | 1 |
| Howard N. Potts Awards | 1 |
| John Price Wetherill Awards | 2 |
| Edward Longstreth Medal Awards | 4 |
| Certificate of Merit Awards | 3 |
| | — |
| | 14 |

REPORT OF THE COMMITTEE ON BARTOL RESEARCH FOUNDATION

FOR THE FISCAL YEAR ENDING DECEMBER 31, 1925

To the President and Members of The Franklin Institute:

During the fiscal year, just ended, considerable progress has been made in getting under way the work of the Bartol Foundation. While a Director has not yet been appointed, research work of a fundamental nature dealing with problems in electricity is being carried out under the direct supervision of Dr. W. F. G. Swann, of the Sloane Laboratory, Yale University, and Prof. E. P. Adams, of Princeton University, these two gentlemen being members of an Advisory Committee appointed to direct the scientific activities of the Foundation until a Director is chosen.

One Fellow, Dr. Arthur Bramley, recently of Princeton University, has been appointed and is now engaged at the Foundation Laboratories. Additional Fellows are under consideration, several of whom will probably be appointed as soon as they can be released from the work upon which they are now engaged in other scientific institutions.

In addition, special investigations are being carried out at the Foundation by Professors Swann and Adams through their personal assistants. During the summer Doctor Swann conducted an experiment in Sweden with the idea of securing evidence of a Corpuscular Radiation of Cosmic Origin. The results of this investigation will be published in the JOURNAL OF THE FRANKLIN INSTITUTE as a contribution from the Bartol Research Foundation. The apparatus used by Doctor Swann was made in the machine shops of the Foundation.

A glass blower has been engaged and a shop and laboratories are now fully equipped and prepared to construct and assemble any apparatus likely to be needed in connection with problems now under consideration.

The Personnel Committee consisting of Doctor Swann, Dean Jos. S. Ames, of the Johns Hopkins University, and Dr. Arthur L. Day, of the Geophysical Laboratory, Washington, is making a careful survey of the field with the idea of securing eight or ten Fellows and also a Director, who will be appointed as soon as a suitable man can be found for the position.

The routine work of the Foundation is being efficiently taken care of by the staff of The Franklin Institute under the able direction of the Secretary, Dr. Howard McClenahan.

While progress in getting the work of the Foundation under way has necessarily been slow, it is now proceeding at a rate which, it is thought, justifies the statement that it will be in full operation during the present year. In the meanwhile, as will be seen from the financial statement included in the Report of the Committee on Finance, a very considerable sum has been added to the principal account.

Respectfully submitted,

C. C. TUTWEILER,
Chairman.

PHILADELPHIA, January 13, 1926.

THE FRANKLIN INSTITUTE AWARDS

FEBRUARY 1, 1925, TO JANUARY 31, 1926

THE FRANKLIN MEDAL

TO

Dr. Elihu Thomson, of Lynn, Mass., "in recognition of his pioneer work in the field of electricity and electrical engineering and of his numerous inventions in these fields."

Professor Pieter Zeeman, of Amsterdam, Holland, "in recognition of his numerous and important contributions in the field of magneto-optics and particularly of his discovery of the effect of a magnetic field upon the frequencies of the light from a radiating source."

THE ELLIOTT CRESSON MEDAL

TO

Mr. Francis Hodgkinson, of Swarthmore, Penna., in recognition of his work in Turbo-electric Appliances.

THE LOUIS EDWARD LEVY MEDAL

TO

Dr. Harvey C. Hayes, of Bellevue, Anacostia, D. C., for his paper entitled "Measuring Ocean Depths by Acoustical Methods" in the JOURNAL.

THE HOWARD N. POTTS MEDAL

TO

Professor C. T. R. Wilson, of Cambridge, England, for his Discovery of a Method of Making the Tracks of Ionizing Rays Visible and Capable of Permanent Record by Photography.

THE JOHN PRICE WETHERILL MEDAL

TO

Mr. Frank Twyman, of London, England, for his inventions embodied in the Hilger Interferometer.

Wagner Electric Corporation, of Saint Louis, Mo., with special mention of Mr. Val A. Fynn and Mr. H. Weichsel, for the Fynn-Weichsel Motor.

THE EDWARD LONGSTRETH MEDAL

TO

Major William E. Hoke, of Washington, D. C., for his inventions embodied in the Hoke Precision Gauge Blocks.

Mr. Thomas M. Chance, of Philadelphia, Penna., for his inventions embodied in the Chance Method and Apparatus for Separating Materials of Different Specific Gravities.

Mr. Daniel H. Meloche, of Detroit, Mich., for his Long Life Molds.

Mr. Thomas Midgley, Jr., of Dayton, Ohio, for his inventions embodied in the Midgley Optical Indicator.

CERTIFICATE OF MERIT

TO

Mr. B. Denver Coppage, of Wilmington, Del., for his inventions embodied in the Plastometer.

Mr. Charles B. Gray, of Buffalo, N. Y., for his inventions embodied in the Gray Sheet Metal Cutter.

Mr. Theodore C. and Mr. Willis O. Prouty, of Hermosa Beach, Calif., for their inventions embodied in the Van Sicklen-Elgin Chronometric Tachometer.

AWARDS

1835-1926

FRANKLIN MEDAL AWARDS

1915-1926

ARRHENIUS, SVANTE AUGUST, PH.D., M.D., D.Sc., LL.D.

"In recognition of his notable contributions to the theory of physical science which have found unprecedentedly extended and fruitful application in the experimental study of chemical, physical, biological and cosmic phenomena, as well as in industrial chemistry."

1920.

CARTY, JOHN J., D.ENG., D.Sc., LL.D., D.S.M.

"In recognition of his long-continued activities in the telephone service, his important and varied contributions to the telephone art, his work in the establishment of the principles of telephone engineering, and his signal success in directing the efforts of a large staff of engineers and scientists to the accomplishment of the telephonic transmission of speech over vast distances."

1916.

DEWAR, SIR JAMES, LL.D., D.Sc., PH.D., F.R.S.E., F.I.C., F.C.S.

"In recognition of his numerous and most important contributions to our knowledge of physical and chemical phenomena and his great skill and inventive genius in attacking and solving chemical and physical problems of the first magnitude."

1919.

EDISON, THOMAS ALVA, PH.D., D.Sc., LL.D.

"In recognition of the value of numerous basic inventions and discoveries forming the foundation of world-wide industries, signally contributing to the well-being, comfort and pleasure of the human race."

1915.

FABRY, CHARLES, D.Sc.

"In recognition of his numerous and highly important contributions in the field of physical science, particularly the solution of optical and spectroscopical problems of fundamental importance."

1921.

FERRIÉ, AUGUSTE GUSTAVE, GENERAL.

"In recognition of his long-continued and successful researches in the field of radio-transmission of intelligence and their splendid and successful military applications, and of his eminent success in the organization

Mr. Thomas M. Chance, of Philadelphia, Penna., for his inventions embodied in the Chance Method and Apparatus for Separating Materials of Different Specific Gravities.

Mr. Daniel H. Meloche, of Detroit, Mich., for his Long Life Molds.

Mr. Thomas Midgley, Jr., of Dayton, Ohio, for his inventions embodied in the Midgley Optical Indicator.

CERTIFICATE OF MERIT

TO

Mr. B. Denver Coppage, of Wilmington, Del., for his inventions embodied in the Plastometer.

Mr. Charles B. Gray, of Buffalo, N. Y., for his inventions embodied in the Gray Sheet Metal Cutter.

Mr. Theodore C. and Mr. Willis O. Prouty, of Hermosa Beach, Calif., for their inventions embodied in the Van Sicklen-Elgin Chronometric Tachometer.

AWARDS

1835-1926

FRANKLIN MEDAL AWARDS

1915-1926

ARRHENIUS, SVANTE AUGUST, PH.D., M.D., D.Sc., LL.D.

"In recognition of his notable contributions to the theory of physical science which have found unprecedently extended and fruitful application in the experimental study of chemical, physical, biological and cosmic phenomena, as well as in industrial chemistry."

1920.

CARTY, JOHN J., D.ENG., D.Sc., LL.D., D.S.M.

"In recognition of his long-continued activities in the telephone service, his important and varied contributions to the telephone art, his work in the establishment of the principles of telephone engineering, and his signal success in directing the efforts of a large staff of engineers and scientists to the accomplishment of the telephonic transmission of speech over vast distances."

1916.

DEWAR, SIR JAMES, LL.D., D.Sc., PH.D., F.R.S.E., F.I.C., F.C.S.

"In recognition of his numerous and most important contributions to our knowledge of physical and chemical phenomena and his great skill and inventive genius in attacking and solving chemical and physical problems of the first magnitude."

1919.

EDISON, THOMAS ALVA, PH.D., D.Sc., LL.D.

"In recognition of the value of numerous basic inventions and discoveries forming the foundation of world-wide industries, signally contributing to the well-being, comfort and pleasure of the human race."

1915.

FABRY, CHARLES, D.Sc.

"In recognition of his numerous and highly important contributions in the field of physical science, particularly the solution of optical and spectroscopical problems of fundamental importance."

1921.

FERRIÉ, AUGUSTE GUSTAVE, GENERAL.

"In recognition of his long-continued and successful researches in the field of radio-transmission of intelligence and their splendid and successful military applications, and of his eminent success in the organization

FRANKLIN MEDAL AWARDS

and directing of the communication service of the French Army during the World War."

1923.

LORENTZ, HENDRICK ANTOON, PH.D., F.R.S.

"In recognition of his researches which have so largely contributed to laying on a new foundation our knowledge of the nature of light and in developing our ideas concerning the ultimate constitution of matter."

1917.

MARCONI, GUGLIELMO, LL.D., D.Sc.

"In recognition of his brilliant inception and successful development of the application of magneto-electric waves to the transmission of signals and telegrams without the use of metallic conductors."

1918.

MENDENHALL, THOMAS CORWIN, PH.D., D.Sc., LL.D., F.A.G.S.

"In recognition of his fruitful and indefatigable labors in physical research, particularly his contributions to our knowledge of physical constants and electrical standards."

1918.

MICHELSON, ALBERT A., PH.D., Sc.D., LL.D.

"In recognition of his numerous and signally fruitful researches in physical science, especially his brilliant discoveries in the fields of optics and astrophysics."

1923.

MODJESKI, RALPH, D.ENG.

"In recognition of his signal achievements as a designer and a builder of structures, mainly bridges, many of them epoch-marking in the history of the engineering profession, beautiful as well as useful, involving on the part of the designer, vision, courage and technique of the highest order."

1922.

ONNES, HEIKE KAMERLINGH, PH.D., D.Sc.

"In recognition of his long-continued and indefatigable labors in low-temperature research, which have enriched physical science, not only with a great number of new methods and ingenious devices, but also with achievements and discoveries of the first magnitude."

1915.

PARSONS, SIR CHARLES ALGERNON, K.C.B., C.B., M.A., LL.D., D.Sc., F.R.S.

"In recognition of his epoch-marking success in the development of the steam turbine, which has revolutionized the art of steam engineering, particularly in regard to the propulsion of mercantile and naval vessels and the driving of electrical generators."

1920.

FRANKLIN MEDAL AWARDS

RICHARDS, THEODORE WM., A.M., PH.D., SC.D., LL.D., CHEM.D., M.D., F.C.S.
"In recognition of his numerous and important contributions to inorganic, physical and theoretical chemistry, and particularly his classical series of redeterminations of the atomic weights of the more important chemical elements."

1916.

RUTHERFORD, SIR ERNEST, KT., D.Sc., LL.D., PH.D., D.PHYS., F.R.S.

"In recognition of long-continued and fruitful researches, signally contributing to the present state of knowledge of the elements, their constitution and relationships."

1924.

SPRAGUE, FRANK J., D.ENG.

"In recognition of his many and fundamentally important inventions and achievements in the field of electrical engineering, notably his contributions to the development of the electric motor and its application to industrial purposes, and in the art of electric traction, signally important in forming the basis of world-wide industries and promoting human welfare."

1921.

SQUIER, GEORGE OWEN, K.C.M.G., D.S.M., PH.D.

"In recognition of his valuable contributions to physical science, his important and varied inventions in multiplex telephony and telegraphy and in ocean cabling and his eminent success in organizing and directing the air and signal services of the U. S. Army in the World War."

1919.

TAYLOR, DAVID WATSON, D.ENG., D.S.M.

"In recognition of his fundamental contributions to the theory of ship resistance and screw propulsion and of his signal success in the application of correct theory to the practical design of varied type of war vessels in the U. S. Navy."

1917.

THOMSON, ELIHU, PH.D., SC.D., LL.D.

"In recognition of his pioneer work in the field of electricity and electrical engineering and of his numerous inventions in these fields."

1925.

THOMSON, SIR JOSEPH JOHN, O.M., F.R.S., D.Sc., F.R.S.E., LL.D., PH.D.

"In recognition of the immeasurable service he has rendered to the world as teacher and leader of thought in that domain of science, especially related to a fundamental knowledge of electricity and the constitution of matter."

1922.

WESTON, EDWARD, LL.D., SC.D.

"In recognition of discoveries and inventions in the field of electricity,

FRANKLIN MEDAL AWARDS

immeasurably fruitful and fundamentally contributory to the establishment of the electric art."

1924.

ZEEMAN, PIETER, PH.D., SC.D.

"In recognition of his numerous and important contributions in the field of magneto-optics and particularly of his discovery of the effect of a magnetic field upon the frequencies of the light from a radiating source."

1925.

CRESSON MEDAL AWARDS

1856-1926

ACKER, C. E.

Process of Manufacturing Caustic, etc.—1902.

ALBERT, CHARLES F.

Violins and Bows.—1887.

AMERICAN COTTON COMPANY.

Round Lap Bale System.—1901.

AMERICAN PAPER BOTTLE COMPANY.

Paper Bottles for Various Purposes.—1906.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY.

Contributions to the Modern Telephone Art.—1916.

ATWATER, W. O., and ROSA, E. B.

Respiration Calorimeter.—1900.

AUTOMATIC ELECTRIC COMPANY.

Automatic Telephony.—1910.

BAEYER, J. F. A. VON.

Research Work in Organic Chemistry.—1912.

BALDWIN LOCOMOTIVE WORKS.

Contributions to the Evolution of the American Locomotive.—1907.

BATCHELLER, C. H.

Compound Locomotive.—1893.

BATES, STOCKTON; SHAW, EDWIN, and VON CULIN, G. M.

Spindle Support.—1891.

BELL, ALEXANDER GRAHAM.

Electrical Transmission of Speech.—1912.

BERLINER, EMILE.

Telephony and Sound Reproduction.—1913.

BEVINGTON, J. H.

Welding Metal and Spinning and Shaping Tools.—1891.

BILGRAM, HUGO.

Bevel Gear Cutter.—1887.

BONWILL, W. G. A.

Electro-magnetic Dental Mallet.—1876.

BORSCH, LOUIS.

Solid Invisible Bifocal Lens.—1907.

CRESSON MEDAL AWARDS

BOWER, HENRY.

Inodorous Glycerine.—1878.

BRASHEAR, JOHN A.

Leading Work in Astronomic Science.—1910.

CASTNER, H. Y.

Electrolytic Process of Decomposing Alkaline Chlorides for the Production of Caustic and Chlorine.—1897.

CHABOT, CYPRIEN.

Shoe Sewing Machine.—1885.

CHAMBERS BROTHERS.

Bolt and Rivet Clipper.—1878.

CHARLTON, J.

Shaft Coupling.—1876.

CLAMER, G. H.

Methods of Eliminating Metals from Mixture of Metals.—1904.

COOPER-HEWITT, P.

Mercury Rectifier.—1910.

CORSCADEN, T.

All-wrought Steel Belt Pulley.—1898.

COWLES, EUGENE H. AND ALFRED H.

Electric Smelting Furnace.—1887.

COWPER, EDWARD A., AND ROBERTSON, T. HART.

Writing Telegraph.—1889.

CROOKES, SIR WILLIAM.

Discoveries in Chemistry.—1912.

CURIE, PIERRE AND MARIE.

Researches Resulting in the Discovery of Radium.—1909.

DEFORREST, LEE.

The Audion.—1922.

DELANDTSHERE, NORBERT.

Machine for Treating Flax.—1879.

DELANY, P. B.

Synchronous Multiplex Telegraphy.—1886.

DELANY, P. B.

System of Machine Telegraphy.—1896.

DELANY, P. B.

Telepost.—1908.

DIESEL, R.

Diesel Motor.—1901.

DODGE, J. M.

System of Storing Coal.—1904.

DUDLEY, P. H.

Dynamograph.—1877.

EDER, J. MARIA.

Researches in Photochemistry.—1914.

CRESSON MEDAL AWARDS

ELDRED, BYRON E.

Low-expansion Leading-in Wire for Incandescent Electric Lamps.—1921.

EMMET, WILLIAM LeROY.

Work on Electrical Propulsion of Ships and Prime Movers.—1920.

FERRILL, J. L.

Process of Fireproofing Wood.—1903.

FISCHER, EMIL.

Contributions to Organic Chemistry.—1913.

FISKE, B. A.

Range Finder.—1892.

FISS, BARNES, ERBEN & Co.

Worsted Yarns.—1875.

FORBES, JOHN S., AND WATERHOUSE, A. G.

Art of Automatically Heating and Sterilizing Fluids.—1901.

FRITZ, JOHN.

Advancement of Steel Industries.—1910.

GAEDE, W.

Molecular Air Pump.—1909.

GANS, ROBERT.

Permutit.—1916.

GAYLEY, J.

Dry Air Blast in Blast Furnace Operation.—1909.

GILL, W. L.

School City.—1903.

GOLDSCHMIDT, HANS.

Alumino-thermics.—1904.

GOLDSCHMIDT, V.

New Theory of Musical Harmony.—1903.

GRAY, E.

Telautograph.—1897.

GRAY NATIONAL TELAUTOGRAPH COMPANY.

Telautograph.—1912.

GRISCOM, W. WOODNUT.

Electric Motor and Battery.—1881.

HADFIELD, SIR ROBERT A.

Advancement of Metallurgical Science.—1910.

HAMMER, W. J.

Historic Collection of Incandescent Electric Lamps.—1906.

HAMMOND, J.

Typewriter.—1890.

HAUPT, L. M.

Reaction Breakwater.—1901.

HAYES, MAYER AND COMPANY.

Manufacture of Files.—1890.

CRESSON MEDAL AWARDS

HEANY, J. ALLEN.

Fireproof Insulated Wire.—1907.

HERSCHEL, CLEMENS.

Venturi Meter.—1898.

HODGKINSON, FRANCIS.

Turbo-electric Appliances.—1925.

HOLLERITH, H.

Electric Tabulating Device.—1890.

HOLMES, P. H.

Lubricant Bearing.—1892.

HOUGH, R. B.

Contributions to the Characteristics and Uses of the American Woods.—1908.

HOWE, H. M.

Experimental Research on Steel.—1895.

HOWE, H. M.

Metallurgy of Steel.—1892.

IVES, FREDERICK E.

Color Photography.—1893.

JENKINS, C. FRANCIS.

"Phantoscope."—1898.

JOHNSON, RAYMOND D.

Hydraulic Valve.—1923.

KINGSBURY, ALBERT.

Thrust Bearing.—1923.

LANSTON, T.

Monotype Machine.—1896.

LEVY, L. E.

Acid Blast Method and Apparatus for Etching Metal Plates.—1900.

LEVY, L. E.

Machine for Powdering Plates for Etching.—1904.

LEWIS, COL. ISAAC NEWTON.

Machine Gun.—1918.

LINDE, KARL P. G.

Refrigeration Processes.—1914.

LOWE, THADDEUS S. C.

Water Gas Process and Apparatus.—1886.

LOVEKIN, L. D.

Expanding and Flanging Machinery and Tools for all Classes of Tubes.—1904.

LUMIÈRE, AUGUSTE AND LOUIS.

Color Photography.—1909.

CRESSON MEDAL AWARDS

MALLET, A.

Articulated Compound Locomotive.—1908.

MARKS, G. E.

Improvements in Artificial Limbs.—1893.

MASON AND HAMLIN COMPANY.

Liszt Organ.—1901.

MERGENTHALER, O.

Linotype.—1889.

MICHELSSEN, A. A.

Work in Physical Optics.—1912.

MOISSAN, HENRI.

Investigations with the Electric Furnace.—1898.

MORLEY, E. W.

Determination of Fundamental Magnitudes in Chemistry.—1912.

NOBLE, ALFRED.

Achievements in Civil Engineering.—1912.

NORTHRUP, EDWIN F.

Electric Furnace and High Temperature Investigations.—1917.

OLSEN, TINIUS.

Testing Machine.—1891.

OTT AND BREWER.

China and Porcelain Wares.—1886.

OUTERBRIDGE, A. E., JR.

Molecular Structure of Cast Iron.—1904.

OWENS, MICHAEL J.

Bottle Blowing Machine.—1915.

PARKER, J. C.

Steam Generator.—1902.

PECKOVER, J.

Stone Sawing Machine.—1895.

PELTON, LESTER A.

Water Wheel.—1894.

PENCOYD IRON WORKS.

Bridge Construction.—1900.

PHILLIPS, F.

Pressed Steel Pulley for Power Transmission.—1907.

POWERS AND WEIGHTMAN.

Exhibit at The Franklin Institute Exhibition of 1874.—1875.

PRATT AND WHITNEY COMPANY.

System of Interchangeable Cut Gears.—1886.

PUPIN, M. I.

Art of Reducing Attenuation of Electrical Waves and Apparatus.—1905.

RAMSAY, R. H.

Railway Car Transfer Apparatus.—1886.

ORESSON MEDAL AWARDS

- RAMSAY, SIR WILLIAM.
Discoveries in Chemistry.—1913.
- RANDOLPH, ISHAM.
Achievements in Civil Engineering.—1913.
- RAYLEIGH, LORD.
Researches in Physical Science.—1913.
- ROBERTSON, T. HART, and COWPER, ED. A.
Writing Telegraph.—1889.
- ROENTGEN, W. C.
Investigations of a New Kind of Ray.—1897.
- ROSCOE, SIR H. E.
Researches in Chemistry.—1912.
- RUTHERFORD, SIR ERNEST.
Advancement of Knowledge of Electrical Theory.—1910.
- SAUVEUR, A.
Metallography of Iron and Steel.—1910.
- SHAW, EDWIN; BATES, STOCKTON; VON CULIN, G. M.
Spindle Support.—1891.
- SHAW, THOMAS.
Automatic Device for Testing Mine Gases and System of Mine Signaling.—1887.
- SIMONDS, G. F.
Universal Rolling Machine.—1889.
- SMITH, EDGAR F.
Work in Electrochemistry.—1914.
- SPELLIER, LOUIS H.
Time Telegraph.—1881.
- SPRAGUE, F. J.
Multiple Unit System of Electric Traction.—1903.
- SQUIER, MAJOR GEO. OWEN.
Multiplex Telephony.—1912.
- STEINMETZ, C. P.
Application of Analytics to Electrical Engineering.—1913.
- STRATTON, S. W.
Leading Work in Metrology.—1912.
- TALBOT, B.
Open Hearth Steel Process.—1909.
- TATHAM, W. P.
Printing Press.—1875.
- TAYLOR, E. R.
Electric Furnace and Process of Manufacturing Bisulphide of Carbon.—1907.
- TAYLOR, FREDERICK W., AND WHITE, MAUNSEL.
Process of Treating Tool Steel.—1902.

CRESSON MEDAL AWARDS

TESLA, NIKOLA.

Alternating Electric Currents of High Frequency.—1894.

THOMSON, ELIHU.

Industrial Applications of Electricity.—1912.

THOMSON, JOSEPH J.

Leading Work in Physical Science.—1910.

TILGHMAN, B. C.

Sand Blast.—1875.

TURNER, W. V.

Air Brake Design and Application.—1909.

U. S. GEOLOGICAL SURVEY.

Exhibit of Survey.—1900.

UNDERWOOD TYPEWRITER COMPANY.

Typewriter.—1909.

VAUCLAIN, S. M.

Compound Locomotive.—1891.

VERNAZ, ALEXIS.

Milling Files.—1909.

VON CULIN, G. M.; BATES, STOCKTON; SHAW, E.

Spindle Support.—1891.

WALKUP, L.

Air Brush.—1886.

WATERHOUSE, A. G., AND FORBES, JOHN S.

Art of Automatically Heating and Sterilizing Fluids.—1901.

WELSBACH, CARL AUER VON.

Incandescent Mantles.—1901.

WESTON, EDWARD.

Leading Work in Electrical Discovery and Application.—1910.

WHITE, MAUNSEL, AND TAYLOR, FREDERICK W.

Process of Treating Tool Steel.—1902.

WILCKES, J.

"Econometer."—1898.

WILEY, HARVEY W.

Leading Work in Agricultural Chemistry.—1910.

WOOD, H. A. WISE.

Autoplate Machine.—1909.

WRIGHT, ORVILLE.

Work in Aviation.—1914.

YANKO, PAUL VON.

Piano Keyboard.—1893.

ZENTMAYER, JOSEPH.

Microscopes and Objectives.—1875.

POTTS MEDAL AWARDS

1911-1926

ANDERSON, JOHN A.

Work in Spectroscopy and his Seismograph.—1924.

BARKER, WENDELL A.

Wrenchless Chuck.—1920.

BIZZELL, JAMES A., AND LYON, T. L.

"Plants and Relation to Nitrate in Soils" (Paper).—1912.

BONE, WILLIAM A.

"Surface Combustion" (Paper).—1913.

BULLARD, EDWARD P., JR.

Mult-Au-Matic Machine Tool.—1920.

COBLENTZ, W. W.

"Reflecting Power of Metals" (Paper).—1911.

COKER, E. G.

Method of Determining Stress by Photo-elastic Means.—1922.

DAHLGREN, ULRIC.

"The Production of Light by Animals" (Paper).—1917.

DOWNS, CHARLES RAYMOND, AND WEISS, JOHN MORRIS.

Vapor Phase Oxidation of Benzene to Maleic Acid.—1922.

GAERTNER, WILLIAM.

Design and Manufacture of Scientific Instruments.—1923.

GRAY, ALEXANDER.

"Modern Dynamo Electric Machinery" (Paper).—1918.

HULL, ALBERT W.

"The Crystal Structure of the Common Elements" (Paper).—1923.

HUMPHREYS, WILLIAM J.

"The Thunderstorm and Its Phenomena" (Paper).—1915.

JANNEY, REYNOLD, AND WILLIAMS, HARVEY D.

Hydraulic Speed Gear.—1919.

KENNELLY, A. E.

Linear Hot-wire Anemometer.—1918.

KING, LOUIS V.

Improvement in Linear Hot-wire Anemometers.—1918.

LANDRETH, CLARENCE P.

Direct Oxidation Process.—1919.

LYON, T. L., AND BIZZELL, JAMES A.

"Plants and Relation to Nitrate in Soils" (Paper).—1912.

MCCOLLUM, E. V.

"Nutrition and Physical Efficiency" (Paper).—1921.

POTTS MEDAL AWARDS

MODJESKI, RALPH.

"Design of Large Bridges with Special Reference to Quebec Bridge"
(Paper).—1914.

MOORE, RICHARD B.

"Helium, its History, Properties and Commercial Development" (Paper).
—1922.

MURRAY, W. S.

"Conditions Affecting the Success of Main Line Electrification" (Paper).
—1916.

TATE, ALFRED O.

Electrolytic Waterproofing of Textile Fabrics.—1921.

WEISS, JOHN MORRIS, AND DOWNS, CHARLES RAYMOND.

Vapor Phase Oxidation of Benzene to Maleic Acid.—1922.

WILLIAMS, HARVEY D., AND JANNEY, REYNOLD.

Hydraulic Speed Gear.—1919.

WILSON, C. T. R.

Making the Tracks of Ionizing Rays Visible and Capable of Permanent
Record by Photography.—1925.

LEVY MEDAL AWARDS

1924-1926

FLETCHER, HARVEY.

"Physical Measurements of Audition and Their Bearing on the Theory
of Hearing."—1924.

HAYES, HARVEY C.

"Measuring Ocean Depths by Acoustical Methods."—1925.

WETHERILL MEDAL AWARDS

1925-

TWYMAN, FRANK.

Inventions Embodied in the Hilger Interferometer.—1925.

WAGNER ELECTRIC CORPORATION.

The Fynn-Weichsel Motor.—1925.

LONGSTRETH MEDAL AWARDS

1890-1926

ABBE, C.

"Meteorology" (Paper).—1913.

ABBOTT, ROBERT R.

"Modern Steels and Their Heat Treatment" (Paper).—1916.

LONGSTRETH MEDAL AWARDS

- ACHARD, F. H., KENNELLY, A. E., AND DANA, A. S.
"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—1917.
- ADAMS, L. H., AND WILLIAMSON, E. D.
"The Annealing of Glass" (Paper).—1921.
- ADAMS, W. G., AND FORBES, J. S.
Stop Valve for Radiators.—1893.
- ALEXANDER, JOHN E.
"Phonosphere."—1905.
- ALTENEDER, THEODORE, AND SONS.
Drawing Pen.—1905.
- ARMSTRONG, WM. T., AND COX, JACOB D.
Grip Socket.—1896.
- ARNOLD, B. J.
Magnetic Clutches and System of Electric Power Station Construction.—1903.
- AUSTIN, JOHN T.
Austin Organ.—1917.
- BALL, JOHN D.
"Investigations of Magnetic Laws for Steel and Other Materials" (Paper).—1917.
- BASKERVILLE, C.
"Chemistry of Anæsthetics" (Paper).—1912.
- BATES, E. G.
Typographic Numbering Machine.—1895.
- BAUSH, CHRISTIAN H.
Radial Drilling Machine.—1894.
- BECKER, CHRISTOPHER A.
Chainomatic Balance.—1917.
- BENNETT, CHARLES A.
Typewriter.—1909.
- BERGONIE, J.
Use of A. C. Electro-magnet in Surgery.—1921.
- BLOEDE, V. G.
Process of Tinting Fabrics.—1894.
- BONNELL, RUSSELL, AND SCHMITT, HENRY J.
Gate Valves.—1901.
- BADBURN AND PENNOCK.
Process of Obtaining Alumina from Bauxite.—1893.
- BRANDT, EDWARD J.
Automatic Cashier.—1922.
- BREED, G.
Apparatus for Producing Musical Sounds by Electricity.—1908.
- BRISTOL, W. H.
Recording Pressure Gauge.—1894.

LONGSTRETH MEDAL AWARDS

BROWN, HAROLD P., AND EDISON, THOMAS A.

Rail Bonds and Electrical Contacts.—1899.

CAFFREY, C. S., AND COMPANY.

Improvement in Carriages and Wagons.—1900.

CARTY, J. J.

Bridging Bell System.—1905.

CHAFFEE, E. L.

"Continuous Electric Oscillations" (Paper).—1913.

CHANCE, E. M.

"Pathogenic Mine Atmospheres" (Paper).—1912.

CHANCE, THOMAS M.

Apparatus for Separating Materials of Different Specific Gravities.—1925.

CHENEY, W. L.

Lathe Tool and Support.—1895.

CHENOWETH, A. C.

Method of Constructing Sewers.—1892.

CLARK, WM. H., AND COLLINS, FRANK W.

Ventilating Stove.—1894.

COLLINS, FRANK W., AND CLARK, WM. H.

Ventilating Stove.—1894.

COLT'S PATENT FIRE ARMS MANUFACTURING COMPANY.

Automatic Pistols.—1906.

COOPER, W. S.

Specimens of Aluminum Castings.—1895.

COX, JACOB D., AND ARMSTRONG, WM. T.

Grip Socket.—1896.

CREIGHTON, H. JERMAIN.

"The Deteriorating Action of Salt and Brine on Reinforced Concrete" (Paper).—1918.

CRISFIELD, J. A. P.

Moisture Determinator for Coke and the Like.—1909.

CUMMINGS, H. H.

Speed Controllers.—1903.

CUSHMAN, ALLERTON S.

"Researches on the Corrosion of Iron and Steel" (Paper).—1908.

DANA, A. S., KENNELLY, A. E., AND ACHARD, F. H.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—1917.

DESHLER, CHARLES, AND McALLISTER, EDWARD J.

Portable Photometer.—1900.

DEVÖE, W. R.

Conduit Electric Railway.—1894.

DODGE, WALLACE H.

Wooden Split Pulley.—1891.

LONGSTRETH MEDAL AWARDS

DOOLITTLE, T. B.

Hard Drawn Copper Wire.—1898.

DRAPER, C. W.

Computing Machine with Indicating and Registering Mechanism.—1904.

EBERHARDT, HENRY F., AND ULRICH, F. L.

Radial Gang Cutter.—1904.

EDDISON, WILLIAM BARTON.

Jet Entraining Apparatus.—1921.

EDISON, THOMAS A., AND BROWN, HAROLD P.

Rail Bonds and Electrical Contacts.—1899.

EDWARDS, LEVI TALBOT.

Compound Air-Lift System.—1918.

ELLIOTT, WILLIAM SWAN.

Process and Apparatus for the Deaeration of Liquids.—1924.

ELLIS, CARLETON.

Paint and Varnish Remover.—1916.

EVE, A. S.

"Modern Views on the Constitution of the Atom" (Paper).—1916.

FAY, C. N.; SHOLES, Z. G., AND HOCHKLASSEN, H.

Typewriting Machine.—1901.

FOLLETT, W. I.

Time Stamp.—1906.

FOLMER AND SCHWING MFG. COMPANY.

Graflex Cameras.—1905.

FORBES, J. S., AND ADAMS, W. G.

Stop Valve for Radiators.—1893.

FREAS, SAMUEL T.

"Interlocking" Tooth Saw.—1922.

FRICK, FRED.

Electric Program Clock.—1899.

FULLER, G. W.

"Biochemical and Engineering Aspects of Sanitary Water Supply"
(Paper).—1916.

GOLDMAN, HENRY.

Arithmachine.—1901.

GOODYEAR, CHARLES.

Projection Lantern.—1895.

GRANBERY, J. H.

Stadia Rod.—1909.

HARTNESS, JAMES.

Screw Thread Comparator.—1922.

HEILPRIN, A.

Improved Ventilating Car Window.—1897.

LONGSTRETH MEDAL AWARDS

- HENNING, G. C.
Pocket Recorder for Tests of Materials.—1899.
- HEPBURN, J. S.
"Chemistry of Sugar" (Paper).—1911.
- HERR, H. T.
"Development of Steam Turbines" (Paper).—1914.
- HICKS, THOMAS WILLING.
"Once-Over" Tiller.—1922.
- HILL, F. B.
Improvement in the Treatment of Sewage.—1893.
- HIRSCH, H. H.
Electric Safety Lamp.—1914.
- HITE, B. H.
Sterilization by High Pressure.—1920.
- HOADLEY, H. G.; WILLIAMS, H. D.; AND LEWIS, E. C.
Lever and Ratch Attachment.—1900.
- HOCHKLASSEN, H.; FAY, C. N.; AND SHOLES, Z. G.
Typewriting Machine.—1901.
- HOKE, WILLIAM E.
Precision Gauge Blocks.—1925.
- HOLLINGSHEAD, W. B.
Automatic Disinfectant Ejector.—1898.
- HOLMAN, A. J., AND COMPANY.
Self-Pronouncing Bibles.—1900.
- HOOVEN, OWENS, RENTSCHLER CO.
Hooven Automatic Typewriter.—1917.
- HUMPHREYS, W. J.
"Volcanic Dust, Climatic Changes and Ice Ages" (Paper).—1914.
- HYDE, E. P.
"Physical Production of Light" (Paper).—1911.
- INTERNATIONAL LIGHT, HEAT AND POWER COMPANY.
Incandescent Lamp.—1901.
- INTERNATIONAL MONEY MACHINE COMPANY.
Money Machine.—1917.
- IVES, H. E.; KINGSBURY, E. F.; AND KARRER, E.
"The Physics of the Welsbach Mantle" (Paper).—1919.
- IVES, H. E.
"Artificial Daylight" (Paper).—1915.
- IVES, H. E.
Improvements in Diffraction Color Photographs and Mode of Making Same.—1907.
- IVES, F. E.
Photo-micrographic Process.—1903.
- IVINS, E.
Product of Tube Making.—1894.

LONGSTRETH MEDAL AWARDS

JOHNSTON, A. L.

Automatic Safe Electric Disconnecter.—1894.

JONES, H. C.

"Nature of Solution" (Paper).—1913.

JONES, J. R.

Machine for Rolling Car Wheels.—1892.

KARNS, J. P., COMPANY.

Tunneling Machine.—1909.

KARRER, E.; KINGSBURY, E. F.; AND IVES, H. E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

KELLER, JOSEPH F.

Automatic Die Cutting Machine.—1922.

KEMP, W. W., AND VAN HORN, W. H.

Gas System.—1919.

KENNELLY, A. E.; ACHARD, F. H.; AND DANA, A. S.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—1917.

KINGSBURY, E. F.; KARRER, E.; AND IVES, H. E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

KINKEAD MANUFACTURING COMPANY.

Apparatus for Aligning and Levelling Shafting.—1914.

KITSON, A.

System of Oil Heating and Incandescent Lighting.—1901.

KNAPP, I. N.

"Natural Gas" (Paper).—1913.

KOTHNY, G. L., AND SUCZEK, ROBERT.

Radojet Air Pump.—1920.

KROLL, G.

Convertible Carriage.—1896.

LAIRD, SCHOBBER AND COMPANY.

General Excellence in Manufacturing Shoes.—1900.

LATHROP, E., AND SCHREINER, O.

"Organic Constituents in Soil" (Paper).—1912.

LEDoux, J. W.

Fluid Meter.—1919.

LEEDS, MORRIS E.

Recording Devices.—1920.

LENKER, WILL G.

L-E-Vation Rod.—1915.

LEVY, MAX.

Counting Chamber for Haemocytometer.—1917.

LEWIS, E. C.; WILLIAMS, H. D.; AND HOADLEY, H. G.

Lever and Ratch Attachment.—1900.

LEWIS, JOHN F., AND MATTES, WM. F.

Locomotive Cylinder Lubricator.—1894.

LONGSTRETH MEDAL AWARDS

LEWIS, W.

Inertia Indicator.—1899.

LLOYD, M. G.

"Magnetic Hysteresis" (Paper).—1911.

LODGE, GEORGE.

Electro-magnetic Street Railway System.—1896.

LUCKIESH, M.

"The Visibility of Airplanes" (Paper).—1920.

LUPTON, D., SON AND COMPANY.

Automatic Closing Fireproof Metal Window.—1904.

MACKAY, WILLIAM M.

Operating Valve.—1893.

MCALLISTER, E. J., AND DESCHLER, CHARLES.

Portable Photometer.—1900.

MCBRIDE, THOMAS C.

Locomotive Feed Water Heater.—1924.

MARSH, E. B.

Metallic Corner Bead.—1897.

MATTES, WILLIAM F., AND LEWIS, J. F.

Locomotive Cylinder Lubricator.—1894.

MEEKER, G. H.

New Apparatus and Method in Clinical Chemistry.—1906.

MELOCHE, DANIEL H.

Molds.—1925.

MENLO PARK CERAMIC WORKS.

Decorative Tile and Faience Work.—1890.

MIDGLEY, THOMAS, JR.

Optical Indicator.—1925.

MILEY, HENRY M. AND MICHAEL.

Color Photography.—1905.

MILLER, DAYTON C.

"A 32-Element Harmonic Synthesizer" (Paper).—1917.

MOORE, RICHARD B.

"Biography of Sir William Ramsay" (Paper).—1919.

MORSELL, W. F. C.

Sectional Models for Stereometric Representation.—1903.

NACHOD, CARL P.

Electric Railway Signal System.—1924.

NOISELESS TYPEWRITER COMPANY.

Typewriter.—1922.

NORTHRUP, E. F.

"Vortex Motion in Liquids" (Paper).—1912.

PANTASOTE LEATHER COMPANY.

"Pantasote."—1896.

LONGSTRETH MEDAL AWARDS

PARKE, HARRY S.

Pneumercator Tank and Draft Gauge.—1923.

PFUND, A. H.

Colorimeter, Cryptometer, Paint Film Gauge and Rotating Sector.—1922.

PHILADELPHIA CREMATION SOCIETY.

System of Cremation.—1892.

PITKIN, A. J.

Compound Locomotive.—1891.

PITTLER, J. W. VON.

Turret Lathe.—1903.

PRESTWICH, JOHN ALFRED.

Fluid Gauge.—1918.

RANKIN, GEORGE A.

"Portland Cement" (Paper).—1917.

RECKLINGHAUSEN, M. VON.

"Ultra-violet Rays" (Paper).—1915.

REESE, B. D.

Dirigible Balloon.—1910.

REEVES, MILTON O.

Variable Speed Countershaft.—1900.

REGAN, H. C., JR.

Closed Conduit Electric Railway.—1897.

RICHARDS, G. M.

Automatic Fluid Pressure Friction Clutch.—1897.

RIKER, C. L.

Lavatory.—1900.

RINGLAND, ALBERT, AND SCHOENFUSS, F. H.

Portable Brinell Meter.—1917.

ROBY, HENRY W.

Screw Jack.—1891.

ROEDER, J. R.

Improvement in Windows.—1892.

ROPER, CHARLES.

Safety Propellers.—1909.

ROSENDALE BELTING COMPANY.

Camel Hair Belting.—1893.

ROUSSEL, W. J.

Cipher Code System.—1902.

RUSBY, J. M.

"Industrial Combustible Gases" (Paper).—1914.

RUSHTON, K.

Improvements in Trailing Trucks for Locomotives.—1910.

RUUD, EDWIN.

Instantaneous Automatic Water Heater.—1904.

LONGSTRETH MEDAL AWARDS

- SCHEMERHORN, W. GEORGE.
Folding Boat.—1891.
- SCHLINK, FREDERICK J.
Stabilized Platform Weighing Scale.—1919.
- SCHMIDT, MAX, AND SIEBER, JOSEPH.
Movable Sidewalk.—1894.
- SCHMIDT, HENRY J., AND BONNELL, RUSSELL.
Gate Valves.—1901.
- SCHOENFUSS, FRANK H., AND RINGLAND, ALBERT.
Portable Brinell Meter.—1917.
- SCHREINER, O., AND LATHROP, E.
"Organic Constituents in Soils" (Paper).—1912.
- SCRIPTURE, E. W.
Color Sense Tester.—1903.
- SEITZ, HENRY JEROME.
Coal Loading and Screening Machines.—1904.
- SHARPLES SPECIALTY COMPANY.
Super-Centrifuge.—1916.
- SHAW, H. M.
Lightning Arrester.—1904.
- SHEEN, MILTON ROY.
Expansion Machine for Tunnel Construction.—1924.
- SHELLENBACH, WILLIAM L.
Variable Speed Countershaft.—1903.
- SHOLES, Z. K.; FAY, C. N.; AND HOCHKLASSEN, H.
Typewriting Machine.—1901.
- SIEBER, JOSEPH, AND SCHMIDT, MAX E.
Movable Sidewalk.—1894.
- SKINNER, JOSHUA J.
"Soil Aldehydes" (Paper).—1919.
- SNOOK, HOMER CLYDE.
X-Ray System.—1919.
- SOCIÉTÉ GENEVOISE.
Measuring Machine.—1923.
- SPITZGLASS, JACOB M.
Republic Flow Meter.—1921.
- STAR BRASS MANUFACTURING COMPANY.
Steam Gauge.—1894.
- STEARNS MANUFACTURING COMPANY.
Automatic High Speed Engine.—1892.
- STONE, JOHN STONE.
"Propagation of Electric Waves along Wires" (Paper).—1913.
- STRADLING, GEORGE F.
"Modern Theories of Magnetism" (Paper).—1916.
- STUMPF, J.
Una Flow Steam Engine.—1909.

LONGSTRETH MEDAL AWARDS

SUCZEK, ROBERT, AND KOTHNY, G. L.

Radojet Air Pump.—1920.

TAINTOR, C. C.

Positive Saw-Set.—1895.

TAUSSIG, JOHN H., AND ZEEK, CHARLES F.

Automatic Operation of Water Gas Sets.—1918.

TEAL, B. F.

Anti-friction Universal Joint for Shafting.—1909.

THOMAS, C. C.

"Measurement of Gases" (Paper).—1912.

TIERNAN, MARTIN F., AND WALLACE, C. F.

Chlorinator.—1922.

TOERRING, C. J.

Electric Arc Lamp.—1903.

TOWNSEND, T. F.

Improved Thermometer Support.—1907.

TUCKER, W. H.

Letter and Document Files.—1900.

TURNER, W. V.

"Locomotive Air-brake" (Paper).—1911.

TUTWILER, C. C.

"Recovery of Gas Works By-products" (Paper).—1915.

ULRICH, FREDERICK L., AND EBERHARDT, H. E.

Radial-Duplex Gang Cutters.—1904.

UNDERWOOD, JOHN, AND COMPANY.

Combined Calculating and Typewriting Machine.—1915.

VAN ALLER, TYCHO.

Calorizing Process.—1918.

VAN HORN, WILLIAM H., AND KEMP, WILLIAM W.

Kemp Gas System.—1919.

WAGGNER, B. G.

Prepayment Gas Meter.—1916.

WAGNER ELECTRIC MANUFACTURING COMPANY.

Single Phase Alternating Current Power Motor.—1902.

WAHL ADDING MACHINE COMPANY.

Adding Machine.—1916.

WALLACE, C. F., AND TIERNAN, MARTIN F.

Chlorinator.—1922.

WATERBURY TOOL COMPANY.

Double Universal Joint.—1904.

WEIDLOG, CHARLES B.

Indicator for Boring Machines.—1906.

LONGSTRETH MEDAL AWARDS

WELSBACH LIGHT COMPANY.

Various Manufactured Products.—1901.

WENTWORTH, C. C.

Improvements in Hydraulic Rams.—1903.

WETHERILL, HENRY EMERSON.

New Physical Diagnostic Instruments.—1906.

WHEELER, GEORGE A.

Step Type Escalator.—1914.

WHITE, J. J.

Journal Box.—1891.

WHITEHEAD, J. B.

"The Electric Strength of Air and Methods of Measuring High Voltage"
(Paper).—1918.

WILLIAMS, BROWN AND EARLE.

Kerosene Lamp for Magic Lanterns.—1902.

WILLIAMS, H. D.; HOADLEY, H. G.; AND LEWIS, E. C.

Lever and Ratch Attachment.—1900.

WILLIAMSON, E. D., AND ADAMS, L. H.

"The Annealing of Glass" (Paper).—1921.

YAWMAN AND ERBE MANUFACTURING COMPANY.

Rapid Roller Copier.—1904.

YOUNG, C. D.

"Locomotive Superheaters" (Paper).—1915.

ZEEK, CHARLES F., AND TAUSSIG, JOHN H.

Automatic Operation of Water Gas Sets.—1918.

ZIMMERMANN, WILLIAM F.

Hob for Worm Gears.—1924.

CERTIFICATE OF MERIT AWARDS

1885-1926

BAYLIS, R. N.

Brush Holder and Brusher for Dynamos.—1909.

BEIN, EMIL J.

Letter and Document Files.—1900.

BINGHAM, EUGENE C.

Viscometer.—1922.

BLANTON, E. A., JR.

Shaft Coupling, Nut Locks, Cams, etc.—1910.

BLONCK, W. A.

Boiler Efficiency Meter.—1914.

BLOUNT, EUGENE I., AND TAYLOR, WARREN H.

Door Check.—1902.

BRANCH, C. J.

Electric Light Shade.—1909.

CERTIFICATE OF MERIT AWARDS

BULLARD, REAR-ADMIRAL W. H. G.

"The Application of Radio to Navigation Problems" (Paper).—1922.

BYERLY, F. E.

Cutter and Cutter Head.—1893.

CANDEE, C. H.

Car Truck and Journal Bearings.—1887.

COOK, J. S.

Self-Lubricating Journal Box.—1898.

COPPAGE, B. DENVER.

Plastometer.—1925.

DEMPSTER, J. T. H.; FLEMING, RICHARD; GENERAL ELECTRIC COMPANY;
AND STEINMETZ, C. P.

Magnetite Lamp.—1908.

DERYCKE, J.

Steam Separator.—1894.

DODGE, W. W.

Wooden Split Pulley.—1885.

DUNN, G. S.

Automatic Electric Brake Motor.—1902.

ELLSWORTH, F. G.

The Knudson and Ellsworth Telephone.—1891.

ELTONHEAD, W. B.

Nut Lock.—1885.

ETCHELLS, HARRY, AND GRAVES, H. A.

Electric Arc Furnace.—1922.

FLEMING, RICHARD; DEMPSTER, J. T. H.; GENERAL ELECTRIC COMPANY;
AND STEINMETZ, C. P.

Magnetite Lamp.—1908.

GENERAL ELECTRIC COMPANY; DEMPSTER, J. T. H.; FLEMING, RICHARD;
AND STEINMETZ, C. P.

Magnetite Lamp.—1908.

GETTY, JOHN K.

Bicycle Support.—1896.

GILSON, EMERY G.

Calorizing Process.—1918.

GLAZIER, JOHN T. AND PETER F.

Universal Nozzle.—1904.

GOWDEY, J.

Compartment Drawer.—1902.

GRAY, CHARLES B.

Sheet Metal Cutter.—1925.

CERTIFICATE OF MERIT AWARDS

GREAVES, H. A., AND ETCHELLS, HARRY.

Electric Arc Furnace.—1922.

GREENE, F. V. AND M. A.

Improvement in Windows.—1892.

HAINES, R. B., JR.

Automatic Micrometer Gauge for Hot Metal.—1896.

HALLANAN, M.

Horseshoe and Pad.—1896.

HALLBERG, J. H.

Current System for Trunk Line Railways.—1906.

HANSON, FREEMAN.

Wood Turning Machine.—1891.

HARBOLSHEIMER, J.

Garbage Box.—1894.

HAVARD, OLIVER D.

Coal Meter.—1918.

HAYS, CHARLES AND JOSEPH.

CO₂ and Draft Recorder.—1920.

HEPBURN, J. S.; ST. JOHN, E. Q.; AND JONES, F. M.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

HILL, EDGAR.

Caliper Measuring Device.—1903.

HILL, MYRON F.

Roller Bearings.—1902.

INTERNATIONAL BURGLAR IMMUNITY CO.

Electric Protective Devices.—1905.

JONES, FRANK MORTON; HEPBURN, J. S.; AND ST. JOHN, E. Q.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

KIDDE, WALTER, AND COMPANY.

Improved System of Detecting and Extinguishing Marine Fires.—1922.

KINNEY, R. D.

Internal Fired Water Tube Boiler.—1899.

LANCE, W. L.

Utilizing Oil Cloth Waste.—1888.

LAND, S.

Sash Cord Fastener.—1886.

LANDAU, DAVID, AND PARR, PERCY H.

"A New Theory of Plate Springs" (Paper).—1920.

MCCHESNEY, R.

Improvements in T-Squares.—1893.

CERTIFICATE OF MERIT AWARDS

MACDONALD, THOMAS H.

Apparatus for Recording Sound.—1900.

MCINTYRE COMPANY.

Electric Wire.—1893.

MCLAUTHLIN, MARTIN B., AND TAYLOR, GEORGE.

Household Garbage Carbonizer.—1895.

MAXON, HARRY R.

Pre-mix Burner.—1923.

MENDENHALL, CHARLES E.

"Aeronautic Instruments" (Paper).—1922.

NABER, H. A.

Gas Voltameter.—1895.

NATIONAL NUTRIENT COMPANY.

Nutrium, a New Food Product.—1902.

NEUMEYER, H. F.

Spray Nozzle.—1895.

NOUY, P. LECOMTE DU.

Surface Tension Apparatus.—1923.

PARR, PERCY H., AND LANDAU, DAVID.

"A New Theory of Plate Springs" (Paper).—1920.

PARVIN, A. B.

Tele-photo Lens.—1895.

PHELPS, W. J.

Hylo-Incandescent Lamp.—1903.

PICH, FRIEDRICH.

Cast Iron Brazing.—1903.

PITNEY, ARTHUR H.

Postage Meter.—1922.

PROUTY, THEODORE C. and WILLIS O.

Chronometric Tachometer.—1925.

REAGAN, JAMES.

Improved Grates.—1900.

RIDGWAY, E. B.

Steam Hydraulic Elevator.—1914.

RINN, J. J.

Tent Fastening.—1904.

ROBINSON, CYRUS R.

Improved Fire Nozzle.—1905.

ROLIN, CHARLES W.

Adjustable and Interchangeable Gate.—1918.

ROWLAND, L. G.

Automatic Safety Device for Electric Circuits.—1897.

SADTLER, J. P. B.

Water Heater for Range Boilers.—1900.

CERTIFICATE OF MEDAL AWARDS

SCHENCK, W. T. Y.

Improved Hose Reels.—1893.

SHEAF, PHILIP A.

Circle Drawing Attachment for Microscopes.—1916.

SIMPSON, W. L.

Steam Separator.—1894.

STEIN, F. J.

An Improved and Simplified System of Pitman Phonography.—1904.

STEINMETZ, C. P.; DEMPSTER, J. T. H.; FLEMING, RICHARD; AND GENERAL
ELECTRIC COMPANY.

Magnetite Lamp.—1908.

ST. JOHN, E. Q.; HEPBURN, J. S.; AND JONES, F. M.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the
Sarraceniaceæ" (Paper).—1921.

SWEETLAND, ERNEST J.

Metallic Filter Cloth.—1918.

SWETT AND LEWIS COMPANY.

Static Machine for X-Ray Apparatus.—1899.

TAYLOR, GEORGE, AND McLAUTHLIN, MARTIN B.

Household Garbage Carbonizer.—1895.

TAYLOR, WARREN H., AND BLOUNT, EUGENE I.

Door Check.—1902.

TUCKFIELD, C. B.

Stove Pipe Anchor.—1896.

VANIER, G. P.

Potash Bulb.—1914.

WARDEN, J. T.

Improved Drawing Board.—1893.

WEBER, GEORGE AND WILLIAM.

Speaking Attachment for Telephone.—1894.

WHINERY, SAMUEL BRENT.

Improved Method of Blueprinting.—1902.

WHITE, E. M.

Chimney for Incandescent Lamp.—1898.

WICKERSHAM, W.

Printers' Quoin.—1894.

WILKES, M.

Automatic Cut-off for Slide Valve Engines.—1889.

TERMS AND PRIVILEGES OF MEMBERSHIP

Members of the Institute shall consist of those engaged or interested in scientific pursuits or in the application of science in the mechanic and industrial arts. All persons interested in the purposes and activities of the Institute and who are willing to further them, may become members when proposed by members in good standing and elected by the Board of Managers. The membership of the Institute shall consist of the following classes of members; *vis.*: Honorary and Corresponding, Endowment, Life, Contributing, Resident, Non-resident, Student, and holders of Second Class Stock.

Honorary and Corresponding members shall be nominated by the Board of Managers and shall require for their election four-fifths of the votes of the members present at any stated meeting of the Institute at which their nomination may be acted upon. They shall not be entitled to vote nor to hold office. All other members shall be elected by the Board of Managers.

Endowment members shall consist of persons, firms, corporations or associations who shall make an endowment payment of five thousand dollars (\$5000) to the Institute, and who, upon acceptance thereof by the Board of Managers, shall thereafter have the privilege of nominating annually to the Board of Managers for election (subject to its discretion as to any particular nominee) as Resident members of the Institute for its then current year, without payment of dues, that number of persons, to be determined from time to time by the Board of Managers, whose annual dues, if they were paying annual Resident Membership dues, would approximately equal but not exceed the then current income from such endowment payments. Such Endowment Memberships shall be perpetual, and shall be transferable by the holders thereof by will or otherwise; provided, however, that the Board of Managers at any time may refund five thousand dollars (\$5000) to the then holders of any such membership, and annul and terminate that membership.

Contributing members shall consist of firms, corporations, associations or individuals who shall pay annually the sum of three hundred dollars (\$300). A contributing member shall have the right to nominate nineteen persons to the Board of Managers for election as Resident members for the year then current, subject to the discretion of the Board as to any particular nominee, and members thus elected shall pay no dues.

Resident Life members, whose membership shall not be transferable, are those members who shall pay the sum of three hundred dollars in any one year.

Non-resident Life members shall be those members who reside permanently at a distance of not less than twenty-five miles from Philadelphia and who shall pay the sum of one hundred dollars in any one year.

Resident members shall be residents of the City of Philadelphia who have been elected to membership in the Institute and who shall pay annual dues of fifteen dollars.

Non-resident members shall be those members who reside permanently at a distance of not less than twenty-five miles from Philadelphia and who shall pay annual dues of five dollars. They shall also pay an initiation fee of five dollars.

Student members shall be over sixteen and under twenty-two years of age. They shall pay annual dues of three dollars if they do not receive the JOURNAL of the Institute, and six dollars if they do receive the JOURNAL. The term of student members shall be limited by the age of twenty-two years, after which time they shall be eligible for transfer to the other types of membership upon the payment of the appropriate fee or dues.

Privileges: All members, of whatever class, are entitled to participate in the meetings of the Institute, in the use of the Library, to receive tickets for the lectures and to receive monthly one copy of the JOURNAL of the Institute, except that student members, and honorary and corresponding members, shall not have the right to vote, nor to hold office, and student members paying the three dollars annual dues shall not receive the JOURNAL of the Institute.

Resignations *must be made in writing, and dues must be paid to the date of resignation.*

Membership Badges.—Pin or button form, may be purchased from the Controller for One Dollar. All badges are numbered and the owner's name and number recorded.

For further information and membership application blanks address the SECRETARY OF THE INSTITUTE.

MEETINGS AND LECTURES

1925-1926

- Wednesday, October 21. Prof. E. G. Conklin, Professor of Biology, Princeton University, Past President American Biological Society, "Why Teach Evolution?"
- Thursday, October 29. Prof. George E. Beggs, Professor of Civil Engineering, Princeton University, "Practical Demonstration of the Mechanical Method for Solving Indeterminate Structures."
- Thursday, November 5. Lieutenant Commander Marion Eppley, U. S. N. R. F., Founder, Eppley Scientific Laboratory, Newport, R. I., "Standard Electrical Cells."
- Thursday, November 12. Prof. Charles B. Bazzoni, Professor of Experimental Physics, University of Pennsylvania, "Ultra-micrometers and Other Applications of Vacuum Tube Circuits."
- Wednesday, November 18. Prof. E. W. Brown, Professor of Astronomy, Yale University, "The Recent Solar Eclipse and Its Results."
- Thursday, December 3. Dr. E. F. Northrup, Inventor and Scientific Head of the Ajax Electrothermic Corporation, "Electric Induction Furnace Working."
- Thursday, December 10. Dr. Walter Van B. Roberts, Consulting Engineer, The Radio Corporation of America, "Recent Developments in Radio Theory."
- Wednesday, December 16. Prof. R. W. Wood, Professor of Experimental Physics, Johns Hopkins University, "Optical Excitation of Metallic Spectra."
- Thursday, January 7. Mr. John Lyle Harrington, C.E., Consulting Engineer, Kansas City, Mo., Past President of the American Society of Mechanical Engineers, "Movable Bridges."
- Thursday, January 14. Dr. Stuart C. Dodd, Professor of Psychology, Princeton University, "Applications and Mechanical Calculation of Correlation Coefficients."
- Wednesday, January 20. Dr. C. E. K. Mees, Director, The Research Laboratories, Eastman Kodak Company, "The Color Sensitivity of Photographic Materials."
- Thursday, January 28. Dr. Chas. H. Mayo, The Mayo Clinic, Rochester, Minn., "Light and Health."
- Thursday, February 4. Dr. Louis C. Loewenstein, Consulting Electrical Engineer, "Latest and Future Development in Power Generation."
- Thursday, February 11. Dr. E. W. Smith, Factory Engineer, Electric Storage Battery Company, "Storage Batteries."
- Wednesday, February 17. Prof. Theodore Lyman, Jefferson Physical Laboratory, Harvard University, "Radiations."

- Thursday, February 25. Prof. Malcolm MacLaren, Chairman, Department of Electrical Engineering, Princeton University, "The Interpole Motor: Its Theory and Development."
- Thursday, March 4. Joint Meeting, Philadelphia Branch, American Society of Civil Engineers, and The Franklin Institute, "The Delaware Bridge"—"The Erection of the Suspended Structure," R. G. Cone; "The Cable Calculations," G. M. Rapp; "The Construction of the Cables," H. D. Robinson; Engineers, Delaware River Bridge Joint Commission.
- Thursday, March 11. Prof. W. Chattin Wetherill, Department of Commerce, Washington, D. C., Department of Mechanical Engineering, University of Pennsylvania, "Elimination of Waste in Industry."
- Wednesday, March 17. Colonel E. L. Jones, Director, United States Coast and Geodetic Survey, Washington, D. C., "Science and the Earthquake Peril."
- Thursday, March 25. Dr. T. G. Delbridge, Supervisor, Process Division, The Atlantic Refining Company, "The Cracking of Petroleum."
- Thursday, April 1. Mr. W. A. Bentley, Jericho, Vt., "Marvels of Snow Flakes and Water Forms."
- Thursday, April 8. Prof. H. F. Moore, Material Testing Laboratory, University of Illinois, "Fatigue Phenomena in Metals."
- Thursday, April 15. Dr. Herbert H. Kimball, Weather Bureau, United States Department of Agriculture, "Solar Radiation and Weather Forecasting."
- Wednesday, April 21. Dr. L. W. McKeehan, Bell Telephone Laboratories, Inc., "Diamagnetism."
- Thursday, April 29. Mr. S. T. Williams, Chief Engineer, Victor Talking Machine Company, "The Recent Development in the Production of Sound."

BARTOL RESEARCH FOUNDATION LECTURES

LECTURES BY DR. E. O. HULBURT

NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., ON MARCH 9, 12 AND 17, 1926, AT FOUR O'CLOCK, P.M.

Tuesday, March 9—"THE KENNELLY-HEAVISIDE LAYER AND RADIO WAVE PROPAGATION."

A quantitative theory, giving a clear picture of the manner of the passage of radio waves over the surface of the earth, has resulted from the recognition and measurement of the "skip distance" for radio waves below 40 metres in length. The electrons of the upper atmosphere, known as the Kennelly-Heaviside Layer, activated by the earth's magnetic field, play a crucial rôle. The shorter waves are propagated long distances by refraction in the layer and reflection at the ground, not by earth-bound waves, reaching heights of about 100 miles. At this height there are 10^8 electrons per c.c. The theory explains many complex phenomena of fading, directional variation, and reception with vertical and horizontal Hertz antennæ. It predicts that waves below 14 metres cannot be used efficiently for long-distance terrestrial communications, but offer a possibility of interplanetary communication.

Friday, March 12—"HYDROGEN SPECTRUM LINES IN THE STARS AND IN THE LABORATORY."

The Balmer series of hydrogen, the simplest series of the simplest of terrestrial elements, finds its most striking development in the spectra of the stars and in the "flash spectrum" of the sun. The lines themselves vary greatly in the different spectra, being bright, dark, narrow, broad, singly, doubly, triply and asymmetrically reversed, etc. The investigations of these lines, although only partly accomplished with the relatively weak apparatus of the laboratory, combined with modern theories of Stark Effect and ionization, contribute definite knowledge of the conditions in the stellar atmospheres. In some stars are indicated large expanses of glowing hydrogen at a low pressure suffused with many electrons. In other stars more complex conditions of pressure, etc., evidently exist. The behavior of certain stellar hydrogen lines remains unexplained.

Wednesday, March 17—"THE PRESSURE OF LIGHT ON ELECTRONS."

Expressions for the pressure of a beam of electromagnetic radiation on a cloud of electrons are derived on a classical and a quantum theory. The classical calculation makes use of the usual formulæ of radiation pressure. The quantum calculation is statistical and involves the Compton Effect and the Correspondence Principle. For wave-lengths below 0.01\AA the quantum expression predicts less pressure than the classical one. Numerical estimates indicate that the pressure is small unless there are many electrons or intense radiation, as may exist in stellar atmospheres, and offer an explanation of the negative results of H. A. Wilson, Langmuir and others, and of the positive results of the fish track experiments of C. T. R. Wilson and of Bothe.

LECTURES BY L. W. McKEEHAN, Ph.D.

BELL TELEPHONE LABORATORIES, INCORPORATED, NEW YORK CITY, MEMBER
OF THE INSTITUTE

On April 13, 16 and 21, 1926, at Four O'Clock, P.M.

MAGNETOSTRICTION AND RELATED PHENOMENA

Tuesday, April 13. Magnetostriction in iron, nickel and cobalt. Early experiments, converse effects, mathematical theories, later experiments, physical theories, behavior of single crystals.

Friday, April 16. Magnetostriction in alloys and compounds. Changes in permeability, hysteresis and electrical resistance, particularly in iron-nickel alloys; experiments and theory; atomic magnetostriction.

Wednesday, April 21. Magnetostriction in non-uniform bodies. Origins and effects of inhomogeneity and anisotropy; internal strain; annealing and quenching; orientation of crystals.

MEMBERSHIP DIRECTORY

HONORARY MEMBERS

- Brigadier-General **JAMES ALLEN**, U. S. A. (Retired), Army and Navy Club, Washington, D. C.
 Colonel **GEORGE L. ANDERSON**, U. S. A. (Retired).
 Prof. **SVANTE AUGUST ARRHENIUS**, Nobel Institute, Stockholm, Sweden.
 Brigadier-General **JOHN J. CARTY**, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
 Mr. **THOMAS A. EDISON**, Orange, New Jersey.
 Prof. **CHARLES FABRY**, Professor of Physics, University of Paris, 1 Rue Victor-Cousin, Paris (Se), France.
 General **G. FERRIE**, Inspecteur des Services de la Telegraphie Militaire et des Transmissions, 51 bis, Boulevard Latour-Maubourg, Paris, France.
 Prof. **GEORGE FORBES**, No. 11 Little College Street, Westminster, S. W., London, England.
 Prof. **HENDRIK A. LORENTZ**, Zylweg 76, Haarlem, Holland.
 Senator **GUGLIELMO MARCONI**, Royal Italian Senate, Rome, Italy.
 Dr. **A. A. MICHELSON**, Professor of Physics, University of Chicago, Chicago, Illinois.
 Dr. **RALPH MODJESKI**, 818 Widener Building, Philadelphia, Pennsylvania.
 Rear-Admiral **JOSEPH B. MURDOCK**, U. S. N. (Retired), Danbury, New Hampshire.
 The Hon. Sir **CHARLES A. PARSONS**, 6 Windsor Terrace, Newcastle-on-Tyne, England.
 General **JOHN J. PERSHING**, War Department, Washington, D. C.
 Mr. **RALPH W. POPE**, 570 Cherry Street, Elizabeth, New Jersey.
 Prof. **THEODORE WILLIAM RICHARDS**, Wolcott Gibbs Memorial Laboratory, Harvard University, Cambridge, Massachusetts.
 Sir **ERNEST RUTHERFORD**, Cavendish Professor of Experimental Physics, The University of Cambridge, Cambridge, England.
 Rear-Admiral **WILLIAM S. SIMS**, U. S. N., General Board, Naval War College, Newport, Rhode Island.
 Mr. **FRANK J. SPRAGUE**, Consulting Engineer, President, Sprague Safety Control and Signal Corporation, 421 Canal Street, New York City, New York.
 Hon. **WILLIAM C. SPROUL**, 117 South Sixteenth Street, Philadelphia, Pennsylvania.
 Major-General **GEORGE OWEN SQUIER**, War Department, Washington, D. C.
 Rear-Admiral **DAVID WATSON TAYLOR**, U. S. N., 1813 19th Street, N. W., Washington, D. C.
 Dr. **ELIHU THOMSON**, 22 Monument Avenue, Swampscott, Massachusetts.
 Sir **JOSEPH J. THOMSON**, Trinity College, Cambridge, England.
 Prof. **WILLIAM CAWTHORNE UNWIN**, Palace Gate Mansions, Kensington, London, England.
 Dr. **EDWARD WESTON**, President, Weston Electrical Instrument Company, Newark, New Jersey.
 Dr. **H. W. WILEY**, Room 1120, Woodward Building, Washington, D. C.
 Dr. **PIETER ZEEMAN**, Stadhouderskade 158, Amsterdam, Holland.

CORRESPONDING MEMBERS

- Prof. **A. S. EVE**, McGill University, Montreal, Canada.
 Prof. **JOHN SEALY TOWNSEND**, New College, Oxford, England.

IN MEMORIAM

Mr. **ISAAC B. THORN**.

MEMBERS

- ABBOTT, ROBERT R.**, Metallurgical Engineer, The Peerless Motor Car Company, Cleveland, Ohio.
ABRAMS, PETER, 918 Chestnut Street, Philadelphia, Pennsylvania.
ACHESON, Dr. EDWARD G., Manufacturer, Acheson Corporation, Æolian Building, 35 West 42nd Street, New York City, New York.
ADAMS, BENJAMIN FRANKLIN, Vice-President, Charles F. Adams, 218-224 North Water Street, Lancaster, Pennsylvania, and for mail, 632 West Chestnut Street, Lancaster, Pennsylvania.
ADAMS, MERRITT H., Woodlawn Terrace, Beechhurst, Long Island.
ADDICKS, WALTER R., President, Consolidated Gas Company of New York, 130 East 15th Street, New York City, New York.
ADSIT, CHARLES G., Engineer, 555 Electric and Gas Building, Atlanta, Georgia.
AERTSEN, GUILLIEM, Engineer, Bethlehem Steel Company, 1637 Widener Building, Philadelphia, Pennsylvania.
AIKEN, FRANK, 401 Abbottsford Road, Philadelphia, Pennsylvania.
AKELEY, CARL E., Taxidermist and Sculptor, American Museum of Natural History, 77th Street and Central Park West, New York City, New York.
AKIMOFF, NICHOLAS W., Mechanical and Hydraulic Engineer, 1013 Harrison Building, Philadelphia, Pennsylvania.

- ALBRECHT, A. C.**, Vice-President, North Bros. Manufacturing Company, Lehigh Avenue and American Street, Philadelphia, Pennsylvania.
- ALBRECHT, HERMAN C.**, Electrical Engineer, Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- ALLAN, ANDREW, Jr.**, Manufacturer of Bearing Metals, Harrison, New Jersey.
- ALLEMAN, GELLERT**, Professor of Chemistry, Swarthmore College, and for mail, 8 Whittier Place, Swarthmore, Pennsylvania.
- ALLEN, ARTHUR HARTMAN, Jr.**, Inventor, Victor Talking Machine Company, Camden, New Jersey, and for mail, 4019 Baring Street, Philadelphia, Pennsylvania.
- ALLEN, HENRY B.**, Metallurgical Engineer, 8112 St. Martin's Lane, Chestnut Hill, Philadelphia, Pennsylvania.
- ALLEN, JAMES**, Brigadier-General, U. S. A., Army and Navy Club, Washington, D. C.
- ALLEN, WILLIAM N.**, Retired Chemical Manufacturer, 557 Church Lane, Germantown, Philadelphia, Pennsylvania.
- ALSBERG, Dr. CARL L.**, Stanford University, California.
- AMES, Dr. JOSEPH S.**, Director, Physical Laboratory, The Johns Hopkins University, Baltimore, Maryland.
- ANDERSEN, OLAF**, Geologist, Norges Geologiske Undersokelse, Kronprinsensgt 2, Kristiania, Norway.
- ANDERSON, CYRUS N.**, Patent Lawyer (Attorney-at-Law), 519 Land Title Building, Philadelphia, Pennsylvania, and for mail, 440 Haverford Road, Narberth, Pennsylvania.
- ANDERSON, FRANK**, Mining Engineer, 1172 Harvard Avenue, Salt Lake City, Utah.
- ANDERSON, Colonel GEORGE L.**, U. S. A., Electrical Engineer, address unknown.
- ANDERSON, Dr. ROBERT J.**, 1658 Woodward Avenue, Lakewood, Cleveland, Ohio.
- ANDREAU, ROLAND L.**, Consulting Chemical Engineer and Research Chemist, Laurel Springs, New Jersey.
- ANDREWS, W. S.**, Consulting Electrical Engineer, General Electric Company, Schenectady, New York.
- ANGERER, VICTOR**, Vice-President, Taylor-Wharton Iron and Steel Company, P. O. Box 162, Ridley Park, Pennsylvania.
- ARMSTRONG, WILLIAM R.**, Clerk, Powers-Weightman-Rosengarten Company, Philadelphia, Pennsylvania.
- ARNOLD, Dr. H. D.**, Director of Research, Engineering Department, Western Electric Company, New York City, New York.
- ARNY, Dr. H. V.**, Teacher and Chemist, 115 West 68th Street, New York City, New York.
- ARRHENIUS, SVANTE AUGUST**, Physicist, Nobel Institute, Stockholm, Sweden.
- ASHBROOK, Dr. DONALD S.**, Chemist, 2404 Willard Street, Wilmington, Delaware.
- ASHHURST, JOHN**, Librarian, The Free Library of Philadelphia, 13th and Locust Streets, Philadelphia, Pennsylvania.
- ASHWORTH, HAROLD**, 4925 Pulaski Avenue, Philadelphia, Pennsylvania.
- ATKINSON, ROBERT**, Hampton Institute, Virginia.
- ATLEE, JOSHUA W.**, Naval Architect, William Cramp and Son's Ship and Engine Building Company, and for mail, Riverton, New Jersey.
- ATLEE, WALTER**, Civil Engineer, 6 West Read Street, Baltimore, Maryland.
- ATTERBURY, W. W.**, Brigadier-General, President, Pennsylvania Railroad Company, Broad Street Station, Philadelphia, Pennsylvania.
- ATWATER, RICHARD M., Jr.**, Consulting Mining Engineer, Scarsdale, New York.
- AUSTIN, Dr. LOUIS W.**, Bureau of Standards, Washington, D. C.
- AUSTIN, W. L.**, Vice-Chairman of the Board, The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- AYRES, EUGENE E., Jr.**, Chemical Engineer, Sharples Specialty Company, 23rd and Westmoreland Streets, Philadelphia, Pennsylvania.
- BACHE, DANIEL T.**, Student, 2102 Pine Street, Philadelphia, Pennsylvania.
- BACON, Dr. RAYMOND FOSS**, Chemical Engineer, Chemists Building, 50 East 41st Street, New York City, New York.
- BADENHAUSEN, CARL W.**, Mechanical Engineer, Short Hills, New Jersey.
- BAEKELAND, Dr. L. H.**, Research Chemist, Snug Rock, Harmony Park, Yonkers-on-Hudson, New York.
- BAKER, FRANKLIN, Jr.**, Manufacturer, The Park Lane, 48th and Park Avenue, New York City, New York.
- BAKER, GEORGE FALES**, Physician, 403 Lafayette Building, Philadelphia, Pennsylvania.
- BALCH, ALFRED C.**, Publisher, 227 South 6th Street, Philadelphia, Pennsylvania.
- BALCH, EDWIN S.**, Attorney-at-Law, 1634 Spruce Street, Philadelphia, Pennsylvania.
- BALDWIN, FREDERIC E.** (Retired), 2200 Walnut Street, Philadelphia, Pennsylvania.
- BALLARD, R. H.**, Vice-President and Assistant General Manager, Southern California Edison Company, Edison Building, Los Angeles, California.
- BALLENTINE, WILLIAM I.**, Vice-President, Advance Rumely Company, La Porte, Indiana.
- BALLS, WILLIAM H.**, South Philadelphia High School, Broad and Jackson Streets, Philadelphia, Pennsylvania.
- BANCROFT, JOHN**, Manufacturer, Wilmington, Delaware.
- BANCROFT, JOSEPH**, Vice-President and Treasurer, Joseph Bancroft and Sons, Wilmington, Delaware.
- BANNISTER, J. C.**, Lock Box 26, Boston, Massachusetts.
- BANTA, CLIFFORD**, Chief Chemist, Barrett Company, Margaret and Bermuda Streets, Philadelphia, Pennsylvania.
- BARNES, JAMES**, Professor of Physics, Bryn Mawr College, Bryn Mawr, Pennsylvania.
- BARNES, JOHN HAMPTON**, Attorney-at-Law, Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- BARNETT, EDWIN S.**, Wheat Starch Manufacturer, 7011 Cresheim Road, Mount Airy, Philadelphia, Pennsylvania.

- BARNHART, G. EDWARD**, Aeronautical Engineer, 1547 East Walnut Avenue, Pasadena, California.
- BARR, Major JOHN H.**, Mechanical Engineer, The Barr-Morse Corporation, Ithaca, New York.
- BARRINGER, DANIEL MOREAU**, Geologist and Mining Engineer, 1242 Real Estate Trust Building, Philadelphia, Pennsylvania.
- BARTH, CARL G.**, Consulting Engineer, 424 Whitney Avenue, New Haven, Connecticut.
- BARTOW, EDWARD**, Chemistry Department, State University of Iowa, Iowa City, Iowa.
- BASFORD, G. M.**, President, Locomotive Feed Water Heater Company, Room 719, 17 East 42nd Street, New York City, New York.
- BASSETT, WILLIAM H.**, Technical Superintendent, American Brass Company, Waterbury, Connecticut, and for mail, Cheshire, Connecticut.
- BATES, C. W.**, Electrical Engineer, Philadelphia Electric Company, and for mail, 403 North Narberth Avenue, Narberth, Pennsylvania.
- BATES, E. F.**, 248 Sheldon Street, Philadelphia, Pennsylvania.
- BATES, ONWARD**, Civil Engineer, 934 John's Road, Augusta, Georgia.
- BAZZONI, Dr. CHARLES BLIZARD**, Professor of Experimental Physics, Randal Morgan Laboratories, University of Pennsylvania, Philadelphia, Pennsylvania.
- BEACH, CHARLES S.**, Designer and Machinist, 745 Main Street, Bennington, Vermont.
- BEALE, HORACE A., Jr.**, President, Parkesburg Iron Company, Parkesburg, Pennsylvania.
- BEALE, LEONARD T.**, Secretary, John T. Lewis and Brother Company, 705 Lafayette Building, Philadelphia, Pennsylvania.
- BEATH, E. R.**, Lapidist and Jeweler, 129 South 12th Street, Philadelphia, Pennsylvania.
- BECK, M. A.**, Vice-President and Chief Engineer, Milwaukee Electric Crane and Manufacturing Company, 294 Greenbush Street, Milwaukee, Wisconsin.
- BECKER, IRWIN A.**, Pharmacist, in care of Michael Reese Hospital, 2839 Ellis Avenue, Chicago, Illinois.
- BELFIELD, T. BROOM**, Manufacturer, 1905 Spring Garden Street, Philadelphia, Pennsylvania.
- BELL, JOSEPH PERCY**, Mechanical Engineer, 30th and Race Streets, Philadelphia, Pennsylvania, and for mail, 230 North Monroe Street, Media, Pennsylvania.
- BELL, J. SNOWDEN**, Attorney-at-Law, Box 629, City Hall Station, New York City, New York.
- BEMENT, WILLIAM P.** (Retired), 743 Real Estate Trust Building, Philadelphia, Pennsylvania.
- BENNETT, C. E.**, Electrical Engineer, Georgia Railway and Power Company, Atlanta, Georgia.
- BENNETT, JOSEPH S., Jr.**, 6310 Woodbine Avenue, Overbrook, Pennsylvania.
- BENZON, GEORGE H., Jr.**, Mechanical Engineer, 252 Mather Road, Jenkintown, Pennsylvania.
- BERG, ERNST J.**, Professor of Electrical Engineering, Union College, Schenectady, New York.
- BERG, HOLGER V.**, Chemical Engineer, Newport, Delaware.
- BERG, P. ESKIL**, Electrical Engineer, General Electric Company, Schenectady, New York, and for mail, 14 Lowell Road, Schenectady, New York.
- BERLINER, EMILE**, Engineer, 1458 Columbia Road, Washington, D. C.
- BERLINER, HERBERT S.**, Engineer, Compo Company, Limited, 131 18th Avenue, Lachine, Canada.
- BERRSFORD, A. W.**, care of Nizer Corporation, 7424 Mackie Street, Detroit, Michigan.
- BIDDLE, CHARLES M., Jr.**, Riverton, New Jersey.
- BIDDLE, ELIZABETH C.**, 400 South 15th Street, Philadelphia, Pennsylvania.
- BIDDLE, JAMES C., Jr.**, Abbey of Gethsemani, Trappist Post Office, Kentucky.
- BIDDLE, JAMES G.**, Importer of Scientific Apparatus, Wallingford, Pennsylvania.
- BIDDLE, ROBERT**, President, Biddle-Gaumer Company, 3846-3856 Lancaster Avenue, Philadelphia, Pennsylvania.
- BIERBAUM, CHRISTOPHER H.**, Consulting Engineer, 113 Parkside Avenue, Buffalo, New York.
- BIGELOW, S. LAWRENCE**, Professor of General and Physical Chemistry, University of Michigan, Ann Arbor, Michigan.
- BILGRAM, HUGO**, Machinist, 1235 Spring Garden Street, Philadelphia, Pennsylvania.
- BILLINGS, A. W. K.**, Civil, Mechanical and Electrical Engineer, in care of Brazilian Hydro Electric Company, Limited, Caixa do Correio 2444, Rio de Janeiro, Brasil.
- BILLOW, CLAYTON O.**, Consulting Engineer, 1431 Jarvis Avenue, Rogers Park, Chicago, Illinois.
- BILYEU, THOMAS**, Mechanical Engineer, 697 East Broadway Street, Portland, Oregon.
- BINDER, RICHARD L.**, President, K. and B. Company, Special Electrical Supplies, 931 North 8th Street, Philadelphia, Pennsylvania.
- BINSWANGER, JACK G.**, Technical Director and Chief Chemist, Thomson Wood Finishing Company, 829 North Third Street, Philadelphia, Pennsylvania.
- BIRCH, GEORGE W., Jr.**, Chemist, 19 Fairview Avenue, Highland Park, Delaware County, Pennsylvania.
- BIRKINBINE, CARL PETER**, Engineer, Room 800, Commercial Trust Building, Philadelphia, Pennsylvania.
- BLACKBURN, ARTHUR**, Grain Merchant, 315 Chamber of Commerce, and for mail, 405 Hollen Road (Cedarcroft), Baltimore, Maryland.
- BLACKBURN, CAROLINE D.**, Chemist, 7028 Paschall Avenue, Philadelphia, Pennsylvania.
- BLAIR, A. A.**, Analytical Chemist, 406 Locust Street, Philadelphia, Pennsylvania.
- BLATZ, FREDERICK J.**, Leather Manufacturer, P. O. Box 967, Wilmington, Delaware.
- BLOEDE, VICTOR GUSTAVE**, Manufacturing Chemist, Carroll Post Office, Baltimore, Maryland.
- BLUM, ARTHUR N.**, Mechanical Engineer, Delmar-Morris Apartments, Germantown, Philadelphia, Pennsylvania.

- BODINE, SAMUEL T.**, President, United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- BOEKEL, J.**, Manufacturer of Metal Goods, 518 Vine Street, Philadelphia, Pennsylvania.
- BOERICKE, FELIX A.**, (Retired), Bryn Athyn, Pennsylvania.
- BOERICKE, GIDEON**, Civil Engineer, Wynnewood, Pennsylvania.
- BOERICKE, JOHN J.**, Merion, Pennsylvania.
- BOLTON, Dr. ELMER K.**, Chemist, Jackson Laboratory, Box 525, Wilmington, Delaware.
- BONINE, CHARLES E.**, Consulting and Designing Engineer, Franklin Trust Building, 20 South 15th Street, Philadelphia, Pennsylvania.
- BOOZ, H. C.**, Chief Engineer, Berwind-White Coal Mining Company, 1100 Commercial Trust Building, Philadelphia, Pennsylvania.
- BORIE, BEAUVEAU, Jr.**, Investment Broker, 511 Chestnut Street, Philadelphia, Pennsylvania.
- BORTON, GEORGE W.**, President and General Manager, Pennsylvania Crusher Company, 1324 Stephen Girard Building, Philadelphia, Pennsylvania.
- BOSTWICK, J. VAUGHAN, St. Davids**, Pennsylvania.
- BOURNE, GEORGE L.**, Vice-President, Locomotive Superheater Company, 17 East 42nd Street, New York City, New York.
- BOWEN, SAMUEL B.**, Manufacturer, 4th Street and Sedgley Avenue, Philadelphia, Pennsylvania.
- BOWER, WILLIAM HENRY**, Manufacturing Chemist, 29th Street and Gray's Ferry Road, Philadelphia, Pennsylvania.
- BOYER, MURRAY C.**, Solicitor of Patents, 829 Stephen Girard Building, 21 South 12th Street, Philadelphia, Pennsylvania.
- BRADBURY, Dr. ROBERT H.**, Science Teacher, Southern High School, 2100 Shunk Street, Philadelphia, Pennsylvania.
- BRADDOCK-ROGERS, K.**, 125 West Park Avenue, Haddonfield, New Jersey.
- BRADLEY, A. J.**, Manufacturer, 101 Beekman Street, New York City, New York.
- BRADY, EDWARD J.**, Engineering Research, 3101 Passyunk Avenue, Philadelphia, Pennsylvania.
- BREED, GEORGE**, Consulting Engineer, University Club, 1510 Walnut Street, Philadelphia, Pennsylvania.
- BREWER, Dr. J. EDWARD**, Vice-President and Chief Chemist, Southeast Corner 18th and Cherry Streets, Philadelphia, Pennsylvania.
- BREWER, ROBERT WELLESLEY ANTONY**, Consulting Engineer, 305 Trainer Street, Ridley Park, Pennsylvania.
- BRIESE, FRITZ V.**, Attorney-at-Law, 25 Broad Street, New York City, New York.
- BRIGHT, JOHN IRWIN**, Architect, Devon, Pennsylvania.
- BRINLEY, CHARLES E.**, President, American Pulley Company, 4200 Wissahickon Avenue, Philadelphia, Pennsylvania.
- BRINTON, CLEMENT STARR**, Food Inspection Chemist, 134 South Second Street, Philadelphia, Pennsylvania.
- BRINTON, RUSSELL L.**, 3700 Kensington Avenue, Philadelphia, Pennsylvania.
- BROCK, JOHN W.**, Retired Attorney, 1607 Walnut Street, Philadelphia, Pennsylvania.
- BROMLEY, JOSEPH H.**, Manufacturer, Cheltenham and Wissahickon Avenues, Philadelphia, Pennsylvania.
- BROWN, FRANCIS SHUNK**, Lawyer, 1005 Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- BROWN, GABRIEL SCOTT**, President, Alpha Portland Cement Company, Harrison Building, Philadelphia, Pennsylvania, and for mail, 720 Meixell Street, Easton, Pennsylvania.
- BROWN, RICHARD P.**, President, Brown Instrument Company, Wayne and Windrim Avenues, Philadelphia, Pennsylvania.
- BROWN, T. WISTAR**, 3rd, Attorney, 230 Chestnut Street, and for mail, 5920 City Avenue, Philadelphia, Pennsylvania.
- BROWN, WILLIAM LIKENS**, District Manager, Industrial Works of Bay City, Michigan, and for mail, 1505 Packard Building, Philadelphia, Pennsylvania.
- BROWNSTEIN, BENJAMIN**, Mechanical Engineer, Elwood City, Pennsylvania.
- BRUNKER, ROBERT J.**, Banker, 1000 Walnut Street, Philadelphia, Pennsylvania.
- BRUNNER, FRANK A.**, Drawing Materials, 910 Filbert Street, Philadelphia, Pennsylvania.
- BRUSH, CHARLES F.**, Electrical Engineer, 3725 Euclid Avenue, Cleveland, Ohio.
- BRYANT, Dr. ALICE GERTRUDE**, Physician, 502 Beacon Street, Boston, Massachusetts.
- BUCK, H. W.**, Consulting Engineer, 49 Wall Street, New York City, New York.
- BUCKLEY, Dr. OLIVER E.**, Electrical Engineer, 463 West Street, New York City, New York.
- BUDD, A. Van WYCK**, Berwyn, Prince George County, Maryland.
- BUDD, EDWARD G.**, Machinist, 502 Westview Street, Germantown, Philadelphia, Pennsylvania.
- BUDD, EDWARD G., Jr.**, 127 Pelham Road, Germantown, Philadelphia, Pennsylvania.
- BULLOCK, WILLIAM E.**, Mechanical Engineer, 29 West 39th Street, New York City, New York.
- BUNNELL, STERLING H.**, Vice-President and Manager, Ash Reclaiming Machinery Corporation, 347 Madison Avenue, New York City, New York.
- BUREAU, E. W.**, Bronze Founder, Southeast Corner 23rd and Westmoreland Streets, Philadelphia, Pennsylvania.
- BURGESS, WILLIAM J.**, 940 South 55th Street, Philadelphia, Pennsylvania.
- BURHORN, EDWIN**, Engineer and Contractor, 938 Hudson Street, Hoboken, New Jersey.
- BURK, CHARLES A. D.**, Physical Chemist and Inventor, 21 South Oakland Avenue, Ventnor, New Jersey.
- BURLINGAME, LUTHER D.**, Industrial Superintendent, Brown and Sharpe Manufacturing Company, Providence, Rhode Island.

- BURROUGHS, JOSEPH H.**, Attorney-at-Law, 612 Bullitt Building, Philadelphia, Pennsylvania.
- BURT, MILO C.**, Chemist, 636 Water Street, Bridgeport, Connecticut.
- BURTON, MAURICE CARTER**, Retired Lumber Manufacturer, in care of Edward F. Henson, Lafayette Building, Philadelphia, Pennsylvania.
- BUSSEY, FRANK S.**, Attorney-at-Law, 904 Land Title Building, Philadelphia, Pennsylvania.
- BUTTS, DONALD C. A.**, Research Physicist and Chemist, 1730 Spruce Street, Philadelphia, Pennsylvania, and for mail, 4402 Walnut Street, Philadelphia, Pennsylvania.
- BUXTON, GEORGE E.**, Industrial Engineer, 322 King Street, Pottstown, Pennsylvania.
- BYERS, ISAAC W.** (Retired), Iron River, Michigan.
- BYRD, JOHN**, Metal Worker, address unknown.
- CABOT, GEORGE E.**, 60 State Street, Boston, Massachusetts.
- CAIRD, JAMES M.**, Chemist and Bacteriologist, Proctor's Building, 92 Fourth Street, Troy, New York.
- CALKINS, G. H.**, Manager, General Electric Company, Tenth Floor, Electric Building, Buffalo, New York.
- CALVERT, HAROLD**, Consulting Engineer, Calvert and Barnes, 2114 Sansom Street, Philadelphia, Pennsylvania.
- CAMERON, DR. FRANK K.**, Consulting Chemist, 46 Bransford Apartments, Salt Lake City, Utah.
- CANBY, HENRY M.**, Wholesale Lumberer, 600 Equitable Building, Wilmington, Delaware.
- CANBY, WILLIAM W.**, Fruit Grower, Grants Pass, Oregon.
- CANFIELD, FREDERICK A.**, Mining Engineer, Dover, New Jersey.
- CAPLES, MARTIN J.**, Vice-President, Seaboard Airline Railway Company, and for mail, 701 Stockley Gardens, Norfolk, Virginia.
- CAPP, JOHN A.**, Mechanical Engineer, 1309 Union Street, Schenectady, New York.
- CAPP, S. BUNKER**, Capitalist, P. O. Box 2054, Philadelphia, Pennsylvania.
- CAPPS, W. L.**, Rear-Admiral, U. S. N., Chief Constructor, Bureau of Construction and Repair, Navy Department, Washington, D. C.
- CARD, PAUL QUINNELL**, Instructor in Chemistry, 145 North 10th Street, Philadelphia, Pennsylvania, and for mail, 45 Delaware Street, Woodbury, New Jersey.
- CARTER, EDWARD C.**, Consulting Engineer, 412 Greenwood Boulevard, Evanston, Illinois.
- CARTY, Brigadier-General JOHN J.**, Vice-President and Chief Engineer, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
- CASACOF, CHRISTO**, Consulting Engineer, 138 Rue de la Tombe-Issoire, Paris, France.
- CASPARI, DR. CHARLES E.**, Professor of Chemistry, 2108 Locust Street, St. Louis, Missouri.
- CASSELMAN, WILLIAM S.**, Attorney-at-Law, Secretary, West Jersey Title and Guarantee Company, and for mail, 317 Penn Street, Camden, New Jersey.
- CATON, JOHN J.**, Consulting Electrical Engineer, 321 Mercer Street, Phillipsburg, New Jersey.
- CHAFFEE, E. LEON**, Assistant Professor of Physics, Cruft Laboratory, Cambridge, Massachusetts.
- CHAMBERLAIN, G. E.**, Engineer, 1650 East William Street, Decatur, Illinois.
- CHAMBERS, DR. ARTHUR DOUGLAS**, Chemical Engineer, E. I. du Pont de Nemours and Company, and for mail, 509 Lore Avenue, Wilmington, Delaware.
- CHAMBERS, FRANCIS T.**, Attorney-at-Law, 605-608 New Stock Exchange Building, 1411 Walnut Street, Philadelphia, Pennsylvania.
- CHAMBERS, J. HOWARD**, Chambers Brothers Company, Founders and Machinists, and for mail, 52nd and Media Streets, Philadelphia, Pennsylvania.
- CHANCE, DR. EDWIN M.**, Consulting Chemist and Engineer, care of Day and Zimmermann, 1600 Walnut Street, Philadelphia, Pennsylvania.
- CHANCE, DR. HENRY M.**, Mining Engineer and Geologist, 839 Drexel Building, Philadelphia, Pennsylvania.
- CHANDLER, T. P.**, Architect, Ithan Farm, Radnor, Pennsylvania.
- CHARLTON, RICHARD C.**, 5017 Griscom Street, Frankford, Philadelphia, Pennsylvania.
- CHESTERMAN, FRANCIS J.**, Chief Engineer, The Bell Telephone Company, 261 North Broad Street, Philadelphia, Pennsylvania.
- CHRISMAN, CHAS. S.**, Mechanical Engineer, The United Gas Improvement Company, 435 West Miner Street, West Chester, Pennsylvania.
- CHRISTIANSON, A.**, Chief Engineer, Standard Steel Car Company, and for mail, P. O. Box 877, Butler, Pennsylvania.
- CHURCH, ARTHUR L.**, Secretary of The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- CLAGHORN, CLARENCE R.**, Mining Engineer, 715 Continental Building, Baltimore, Maryland.
- CLAMER, F. J.** (Retired), Collegeville, Montgomery County, Pennsylvania.
- CLAMER, G. H.**, Metallurgist and Chemist, First Vice-President and Secretary, The Ajax Metal Company, Frankford Avenue and Richmond Street, Philadelphia, Pennsylvania.
- CLARK, BEAUVAIS**, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, MISS DARTHELA**, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, Lieutenant-Colonel EDWARD B.**, Publisher, Potomac Hotel, Washington, D. C.
- CLARK, EDWARD L.**, Engineer, American Motor Body Company, 18th Street and Lehigh Avenue, Philadelphia, Pennsylvania.
- CLARK, E. W.**, Banker, 321 Chestnut Street, Philadelphia, Pennsylvania.
- CLARK, FRANK SHAW**, Mechanical Engineer, Stone and Webster Engineering Corporation, 147 Milk Street, Boston, Massachusetts.
- CLARK, JOSEPH S.**, Attorney-at-Law, Highland Avenue, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, THEOBALD F.**, 490 East Abington Avenue, Chestnut Hill, Philadelphia, Pennsylvania.

- CLARK, WALTON**, Consulting Engineer, The United Gas Improvement Company, and for mail, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, Mrs. WALTON**, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, WALTON, Jr.**, Attorney-at-Law, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLOTHIER, MORRIS LEWIS**, Merchant, 801 Market Street, Philadelphia, Pennsylvania.
- CLOUD, JOHN W.**, Chairman, The Westinghouse Brake and Saxby Signal Company, Limited, 82 York Road, King's Cross, London, N. 1, England.
- CLYMER, EVAN MORGAN**, Chief Clerk, Inspector of Hull Material for U. S. Navy, and for mail, 142 East Fishers Avenue, Olney, Philadelphia, Pennsylvania.
- COATES, JESSE**, Consulting Engineer and Metallurgist, 40 Ocean Avenue, Lynn, Massachusetts.
- COBB, H. E.**, Engineering Department, The Bell Telephone Company, 261 North Broad Street, Philadelphia, Pennsylvania.
- COCHRAN, C. B.**, Chemist, State Dairy and Food Commission, and for mail, 514 South High Street, West Chester, Pennsylvania.
- COCKERILL, H. W.**, Technical Clerk, 19 Rata Road, Hataitai, Wellington, New Zealand.
- COFFIN, C. A.**, Chairman of the Board, General Electric Company, 120 Broadway, New York City, New York.
- COLLINGWOOD, J. REED**, Buyer, Fels and Company, and for mail, 510 South 41st Street, Philadelphia, Pennsylvania.
- COLLINS, CHARLES RUSSELL**, Consulting Engineer, 805 Lowman Building, Seattle, Washington.
- COLLINS, HENRY H.**, Manufacturer, 226 Columbia Avenue, Philadelphia, Pennsylvania.
- COLLOM, SAMUEL H.**, President, Pennsylvania Flexible Metallic Tubing Company, 505 Abbott Building, Philadelphia, Pennsylvania.
- COLVIN, CHARLES H.**, Mechanical Engineer, 61 Poplar Street, Brooklyn, New York.
- COLVIN, FRED H.**, Editor, *American Machinist*, Tenth Avenue at 36th Street, New York City, New York, and for mail, 46 Lenox Avenue, East Orange, New Jersey.
- COLVIN, HENRY FRED, 2nd**, 754 Lexington Avenue, Brooklyn, New York.
- COLWELL, ROBERT C.**, Professor of Physics, Geneva College, Beaver Falls, Pennsylvania, and for mail, 332 Demail Avenue, Morganstown, West Virginia.
- COMEY, Dr. ARTHUR M.**, Chemist, 380 Mt. Auburn Street, Cambridge, Massachusetts.
- CONAWAY, JOHN F.**, Secretary and Treasurer, National Umbrella Frame Company, 30th and Thompson Streets, Philadelphia, Pennsylvania.
- CONDICT, G. H.**, Consulting Mechanical and Electrical Engineer, 922 Central Avenue, Plainfield, New Jersey.
- CONN, CHARLES F.**, President, Giant Portland Cement Company, Pennsylvania Building, Philadelphia, Pennsylvania.
- CONVERSE, WILLIAM A.**, Chemical Engineer, Dearborn Chemical Company, McCormick Building, Chicago, Illinois.
- COOKE, MORRIS LLEWELLYN**, Consulting Engineer in Management, Acting Director, The Utilities Bureau, 1009 Finance Building, and for mail, 401 West Walnut Lane, Germantown, Philadelphia, Pennsylvania.
- COOLEY, MORTIMER E.**, Dean, Colleges of Engineering and Architecture, Engineering Building, University of Michigan, Ann Arbor, Michigan.
- COOPER, HENRY**, Manufacturer of Olive Oil, 403 East Valerio Street, Santa Barbara, California.
- COPE, THOMAS D.**, Assistant Professor of Physics, Randal Morgan Laboratory of Physics, University of Pennsylvania, Philadelphia, Pennsylvania.
- COPPAGE, BENJAMIN DENVER**, Production Engineer, Levgor Structural Company, New York City, and for mail, 2402 Willard Street, Wilmington, Delaware.
- COPPAGE, GEORGE L.**, Production Manager, The Pusey and Jones Company, Wilmington, Delaware.
- CORNELIUS, CLARENCE E.**, Salesman, 162 West Coulter Street, Germantown, Philadelphia, Pennsylvania.
- CORNELIUS, JOHN C.**, Architect, 211 West Cheltenham Avenue, Germantown, Philadelphia, Pennsylvania.
- CORNELIUS, JUSTICE C.**, Civil Engineer, 821 Lehigh Street, Easton, Pennsylvania.
- COTTRELL, JAMES W.**, First Lieutenant, Ordnance Reserve Corps, United States Army, Technical Editor, *Motor Transport*—Chilton Class Journal Company, 56th and Chestnut Streets, Philadelphia, Pennsylvania, and for mail, 409 Bellevue Avenue, Hammononton, New Jersey.
- COWAN, WILLIAM ARTHUR**, Assistant Chief Chemist, National Lead Company, 105 York Street, Brooklyn, New York.
- COWLES, ALFRED H.**, President, Electric Smelting and Aluminum Company, Sewaren, New Jersey.
- COX, J. D.**, President, Cleveland Twist Drill Company, Cleveland, Ohio.
- COX, J. F.**, Commercial Department, The Bell Telephone Company, 261 North Broad Street, Philadelphia, Pennsylvania.
- COX, JOHN L.**, Mechanical Engineer, 12 Summit Street, Chestnut Hill, Philadelphia, Pennsylvania.
- COX, WALTER**, President, Pennsylvania Wire Glass Company, Pennsylvania Building, Philadelphia, Pennsylvania.
- COXE, ALEXANDER BROWN**, Agriculturist, Paoli, Pennsylvania.
- COYLE, GEORGE L., S. J.**, Professor of Organic Chemistry, Georgetown University, Washington, D. C.
- CRAGO, WILLIAM H.**, Civil Engineer, in care of Fajardo Sugar Company, Fajardo, Porto Rico.
- CRAIG, ROBERT**, Consulting Engineer, 42 Broadway, New York City, New York.

- CRAMP, FRANCIS L.**, Assistant to President, Wm. Cramp and Sons Ship and Engine Building Company, Philadelphia, Pennsylvania.
- CRAMPTON, GEORGE S.**, Physician, 1819 Walnut Street, Philadelphia, Pennsylvania.
- CRAWFORD, D. F.**, General Manager, Pennsylvania Lines West of Pittsburgh, 5243 Ellsworth Avenue, Pittsburgh, Pennsylvania.
- CREIGHTON, H. JERMAIN**, Associate Professor of Chemistry, Swarthmore College, Swarthmore, Pennsylvania.
- CRENSHAW, Dr. JAMES L.**, Professor of Physical Chemistry, Bryn Mawr, Pennsylvania.
- CRICHTON, ANDREW B.**, U. S. Bank Building, Johnstown, Pennsylvania.
- CROASDALE, JOHN P.**, Attorney-at-Law, 1011 Chestnut Street, Philadelphia, Pennsylvania.
- CROOK, ALFRED**, Vice-President and General Manager, Philadelphia Roll and Machine Company, 25th Street and Washington Avenue, Philadelphia, Pennsylvania.
- CROWELL, WALTER S.**, Chemical Engineer, Oak Lane, Philadelphia, Pennsylvania.
- CULLEN, GEORGE S.**, Insurance, 4504 Springfield Avenue, Philadelphia, Pennsylvania.
- CUMMINGS, J. H.**, President, John B. Stetson Company, Philadelphia, Pennsylvania.
- CUNNINGHAM, J. L.**, Superintendent of Motive Power, Pennsylvania Railroad Company, Pittsburgh, Pennsylvania.
- CURTIS, CYRUS H. K.**, Curtis Publishing Building, Philadelphia, Pennsylvania.
- CURTISS, ELLIOTT**, President and Treasurer, The United States Metallic Packing Company, 429 North 13th Street, Philadelphia, Pennsylvania.
- CURWEN, SAMUEL M.**, President, J. G. Brill Company, and for mail, Haverford, Pennsylvania.
- CUSHMAN, Dr. ALLERTON S.**, Director, The Institute of Industrial Research, 2201 New York Avenue, N. W., Washington, D. C.
- DACOSTA, J. CHALMERS**, 3rd, Mechanical Engineer, Indemnity Insurance Company of America, 232 Walnut Street, Philadelphia, Pennsylvania.
- DANNENBAUM, HERMAN N.**, Manufacturer, Vice-President, National Ammonia Company, Frankford, Philadelphia, Pennsylvania.
- DARROW, KARL K.**, Physicist, 463 West Street, New York City, New York, and for mail, 610 West 111th Street, New York City, New York.
- DASHIELL, BENJ. J.**, Consulting Engineer, Dunkirk P. O., Calvert County, Maryland.
- DASHIELL, P. T.**, Assistant Engineer of Works, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- DAVIDHEISER, LEE**, Professor of Chemistry, Millersville Normal School, Millersville, Pennsylvania.
- DAVIDS, R. W.**, Consulting Electrical Engineer, Merion Station, Pennsylvania.
- DAVIDSON, GEORGE M.**, Chemist and Engineer of Tests, C. & N. W. R. R. Company, Chicago, Illinois.
- DAVIDSON, WARD F.**, Electrical Engineer, 380 Pearl Street, Brooklyn, New York.
- DAVIS, CARLETON E.**, Civil Engineer, 1612 Market Street, Philadelphia, Pennsylvania.
- DAVIS, CHARLES HENRY**, President and Trustee, Bass River, Cape Cod, Massachusetts.
- DAVIS, ERNEST H.**, Manager of Street Railways and Electric Light Plants, 901 Vine Avenue, Williamsport, Pennsylvania.
- DAWES, JAMES H.**, General Contractor, 1310 Arch Street, Philadelphia, Pennsylvania.
- DAWSON, WILFRED THOMAS**, Professor of Physiology, Medical Department, University of Texas, Galveston, Texas.
- DAY, Dr. ARTHUR L.**, Director, Geophysical Laboratory, Carnegie Institution, Washington, D. C.
- DAY, CHARLES**, President, Day and Zimmermann, Engineers, 1600 Walnut Street, Philadelphia, Pennsylvania.
- DAY, ROLAND B.**, Engineer, Room 842, 25 Broadway, New York City, New York.
- DE GRAAFF, ANTONIUS**, Chemical Engineer, Philips' Glowlampworks, Limited, Eindhoven, Holland.
- DELANO, FREDERIC A.**, 407 Hibbs Building, Washington, D. C.
- DELBIDGE, Dr. T. G.**, Atlantic Refining Company, 260 South Broad Street, Philadelphia, Pennsylvania.
- DELLENBAUGH, FREDERICK S., Jr.**, Electrical Engineer, Massachusetts Institute of Technology, and for mail, 91 Spooner Road, Chestnut Hill, Massachusetts.
- DEMPSEY, W. L.**, Patent Attorney and Consulting Engineer, 406 Market Street, St. Louis, Missouri.
- DENIG, FRED**, Combustion Engineer, Box 365, Fort Wayne, Indiana.
- DESHONG, HOWARD T.**, Superintendent, Philadelphia Electric Company, and for mail, 9 Lansdowne Avenue, Lansdowne, Pennsylvania.
- DETWILER, J. G.**, Chemist, Room 913, The Texas Company, Houston, Texas.
- DICKERSON, EDWARD N.**, Attorney-at-Law, 41 Park Row, New York City, New York.
- DIDIER, PAUL**, Principal Assistant Engineer, Baltimore and Ohio Railroad Company, Maloney Building, 339 Second Street, Pittsburgh, Pennsylvania.
- DILLENBECK, CLARK**, Civil Engineer, 209 Pelham Road, Mount Airy, Philadelphia, Pennsylvania.
- D'INVILLIERS, EDWARD VINCENT**, Geologist and Mining Engineer, 121 North Broad Street, Philadelphia, Pennsylvania.
- DISSTON, WILLIAM D.**, Manufacturer, in care of Henry Disston and Sons, Tacony, Philadelphia, Pennsylvania.
- DOANE, SAMUEL E.**, Chief Engineer, National Lamp Works of the General Electric Company, Nela Park, Cleveland, Ohio.
- DOBSON, WILLIAM ALEXANDER**, Naval Architect, Cramp Shipyard, Philadelphia, Pennsylvania, and for mail, 5918 Wayne Avenue, Philadelphia, Pennsylvania.
- DODGE, KERN**, Consulting Engineer, Morris Building, Philadelphia, Pennsylvania.
- DOHERTY, HENRY L.**, President, Cities Service Company, 60 Wall Street, New York City, New York.

- DOLAN, THOMAS J., Chestnutwold Farm, Devon, Pennsylvania.
DONALD, WILLIAM, Chemist and Assayer, Bloomingdale, New Jersey.
DONOHOE, JOHN P., Coal Operator, Coulter Building, Greensburg, Pennsylvania.
DORR, JOHN V. N., Metallurgical and Chemical Engineer, President, The Dorr Company, The Architects Building, 247 Park Avenue, New York City, New York.
DOUGHERTY, CHARLES JAMES, Consulting Engineer, Room 719, 149 Broadway, New York City, New York.
DOUGHERTY, THOMAS HARVEY, Jr., 104 South Fifth Street, Philadelphia, Pennsylvania, and for mail, 230 South 19th Street, Philadelphia, Pennsylvania.
DOUREDOURE, BERNARD L., Student, 103 Walnut Street, Philadelphia, Pennsylvania.
DOUTHIRT, WALSTEIN F., 1752 Equitable Building, New York City, New York.
DOW, HERBERT H., General Manager, The Dow Chemical Company, Midland, Michigan.
DOYLE, WILLIAM J., Contractor and Builder, 1519 Sansom Street, Philadelphia, Pennsylvania.
DRAKE, LEWIS MARVIN, Experimental Scientist, 509 North First Street, Daytona Beach, Florida.
DREXEL, JOHN R., 112 Drexel Building, Philadelphia, Pennsylvania.
DUBILIER, WILLIAM, President, Dubilier Condenser and Radio Corporation, 4377 Bronx Boulevard at 238th Street, New York City, New York.
DUBOSQUE, F. L., Superintendent of Floating Equipment, Pennsylvania Station, New York City, New York.
DUNCAN, J. S., Inventor, 901 West Van Buren Street, Chicago, Illinois.
DUNCAN, THOMAS, President, Duncan Electric Manufacturing Company, Lafayette, Indiana.
DUNDORE, CHARLES R., 8205 Seminole Avenue, Philadelphia, Pennsylvania.
DUNN, GANO, President, J. G. White Engineering Corporation, and for mail, 20 Washington Square, New York City, New York.
DUNNINGTON, F. P., Professor of Chemistry, University of Virginia, Virginia.
Du PONT, IRENEE, Vice-President, E. I. du Pont de Nemours and Company, Wilmington, Delaware.
Du PONT, PIERRE S., President, E. I. du Pont de Nemours and Company, Wilmington, Delaware.
DURBAN, THOMAS E., General Manager, Erie City Iron Works, Erie, Pennsylvania.
D'UTASSY, GEO., Publisher, Cedarhurst, Long Island, New York.
DYER, FRANK LEWIS, Mechanical Expert, 217 Broadway, New York City, New York.
EASON, JOHN STUART, Room 950 Transportation Building, 608 South Dearborn Street, Chicago, Illinois.
EAVENSON, HOWARD N., Engineer, 4311 Bayard Street, Pittsburgh, Pennsylvania.
EBERLE, E. G., 10 West Chase Street, Baltimore, Maryland.
ECKERT, SAMUEL B., Oil Refiner, Finance Building, 1428 South Penn Square, Philadelphia, Pennsylvania.
ECKHARDT, E. A., Marland Oil Company, Ponca City, Oklahoma.
EDGAR, C. L., President and General Manager, Edison Electric Illuminating Company, 70 State Street, Boston, Massachusetts.
EDISON, THOMAS A., Inventor, Orange, New Jersey.
EGLESON, J. ERNEST A., Chemical Engineer, General Chemical Company, Marcus Hook, Pennsylvania, and for mail, 734 Ocean Avenue, Brooklyn, New York.
EGLIN, ARCHIBALD C., Jr., Apprentice in Transportation Department, Pennsylvania Railroad System, Altoona, Pennsylvania, and for mail, Merbrook Lane, Merion, Pennsylvania.
EGLIN, WM. C. L., Vice-President and Chief Engineer, Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
EGLOFF, Dr. GUSTAV, Petroleum Technologist, The Universal Oil Product Company, Strass Building, Chicago, Illinois.
EHRENFELD, Dr. FREDERICK, College Hall, University of Pennsylvania, Philadelphia, Pennsylvania.
EHRET, CORNELIUS D., Patent Lawyer, 6911 Clearview Street, Mount Airy, Philadelphia, Pennsylvania.
ELCOCK, JOHN J., Attorney-at-Law, 1135 Commercial Trust Building, Philadelphia, Pennsylvania.
ELDRED, Dr. BYRON E., 41 East 42nd Street, New York City, New York.
ELKINS, GEORGE W., Vice-President of Companies, Land Title Building, Philadelphia, Pennsylvania.
ELKINTON, HOWARD W., Assistant Manager, Foreign Department, Philadelphia Quartz Company, 121 South Third Street, Philadelphia, Pennsylvania.
ELKINTON, THOMAS W., Philadelphia Quartz Company, 121 South Third Street, Philadelphia, Pennsylvania.
ELLIOT, EDWIN, Foundry Superintendent, 403 West Price Street, Germantown, Philadelphia, Pennsylvania.
ELLIS, CARLETON, Research Chemist and Chemical Engineer, 92 Greenwood Avenue, Montclair, New Jersey.
ELLIS, WILLIAM GODEY, Engineer, 20 South 15th Street, Philadelphia, Pennsylvania.
ELMENDORF, ARMIN, Consulting Engineer, 645 North Michigan Avenue, Chicago, Illinois.
ELMORE, GUY HARTWELL, Consulting Engineer, 1505 Race Street, Philadelphia, Pennsylvania, and for mail, 201 Elm Avenue, Swarthmore, Pennsylvania.
ELVERSON, JAMES, Jr., Publisher, The Philadelphia Inquirer, Philadelphia, Pennsylvania.
EMERICK, J. M., Office Manager, 1501 Commonwealth Building, Philadelphia, Pennsylvania.
EMERSON, GEORGE H., Chief of Motive Power and Equipment, Baltimore and Ohio Railroad, Baltimore, Maryland.
EMERSON, HARRINGTON, Efficiency Engineer, Room 1522, Hudson Terminal Building, 30 Church Street, New York City, New York.

- ENGELHARD, CHARLES**, Importer, Hudson Terminal Building, 30 Church Street, New York City, New York.
- EPPELSHEIMER, DANIEL, Jr.**, Chief Engineer, 419 Broadway, Middletown, Ohio.
- EPPLEY, MARION**, Commander, Scientist, Eppley Scientific Laboratory, Newport, Rhode Island.
- ERHART, WILLIAM H.**, Manufacturing Chemist, 81 Maiden Lane, New York City, New York.
- ERNE, ALFRED**, Clerk, William H. Horstmann Company, and for mail, 20 East Athens Avenue, Ardmore, Pennsylvania.
- ETTENGER, R. L.**, Consulting Mechanical Engineer, Southern Railway, 1300 Pennsylvania Avenue, Washington, D. C.
- EVANS, HENRY CARTER**, Student, Haverford College, Haverford, Pennsylvania.
- EVANS, OWEN BROOKE**, Mechanical Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- EVANS, POWELL**, 2035 Washington Avenue, Philadelphia, Pennsylvania.
- EVANS, WAYNE S.**, Manufacturer of Metal Goods, 4623 Paul Street, Frankford, Philadelphia, Pennsylvania.
- EVE, A. S.**, Professor of Physics, McGill University, Montreal, Canada.
- FABRY, CHARLES**, Professor of Physics, University of Paris, 1 Rue Victor-Cousin, Paris (5c) France.
- FAIRCHILD, S. E., Jr.**, Civil and Mining Engineer, Land Title Building, Philadelphia, Pennsylvania.
- FAIRCHILD, SHERMAN M.**, Engineer, Fairchild Aerial Camera Corporation, 136 West 52nd Street, New York City, New York, and for mail, 898 Park Avenue, New York City, New York.
- FALKENAU, ARTHUR**, Industrial Engineer, 4 East 88th Street, New York City, New York.
- FARRAND, DUDLEY**, Assistant to the President, Public Service Corporation of New Jersey, 80 Park Place, Newark, New Jersey.
- FAUGHT, Dr. L. ASHLEY**, Professor of Operative Dentistry, Philadelphia Dental College, 18th and Buttonwood Streets, Philadelphia, Pennsylvania.
- FEARING, FREDERICK C.**, Consulting Engineer, 2112 Delancey Place, Philadelphia, Pennsylvania.
- FEARON, CHARLES**, Banker, 333 Chestnut Street, Philadelphia, Pennsylvania.
- FEBIGER, C. C.**, 3421 Powelton Avenue, Philadelphia, Pennsylvania.
- FELLOWS, E. R.**, President and General Manager, The Fellows Gear Shaper Company, Springfield, Vermont.
- FELS, MAURICE**, 4323 Spruce Street, Philadelphia, Pennsylvania.
- FELS, SAMUEL S.**, Soap Manufacturer, 39th and Walnut Streets, Philadelphia, Pennsylvania.
- FELTON, EDGAR CONWAY**, President, Pennsylvania Steel Company, and for mail, Haverford, Pennsylvania.
- FELTON, SAMUEL M.**, President, Chicago Great Western Railway, 1121 Peoples Gas Building, Chicago, Illinois.
- FERGUSON, JOHN**, Electrical Engineer, 506 Guaranty Building, Indianapolis, Indiana.
- FERGUSON, LOUIS A.**, Vice-President and Electrical Engineer, Commonwealth Edison Company, Box 767, 72 West Adams Street, Chicago, Illinois.
- FERGUSON, WALTER B.**, 426 School Lane, Germantown, Philadelphia, Pennsylvania.
- FERNALD, ROBERT HEYWOOD**, Whitney Professor of Dynamical Engineering, Mechanical Engineering Department, University of Pennsylvania, Philadelphia, Pennsylvania.
- FERNANDEZ, GUY D.**, Electrical Engineer, Haddon Heights, New Jersey.
- FERREE, Dr. C. E.**, Teacher, Bryn Mawr College, Bryn Mawr, Pennsylvania.
- FERRIE, General G.**, Inspecteur des Services de la Telegraphie Militaire et des Transmissions, 51 bis, Boulevard LaTour-Maubourg, Paris, France.
- FINCH, WILLIAM G. H.**, 286 East 206th Street, New York City, New York.
- FINKBINER, E. W.**, Representative, E. F. Houghton Company, and for mail, 6007 Oxford Street, Philadelphia, Pennsylvania.
- FINLEY, W. H.**, President C. and N. W. Railway Company, and for mail, 412 North Washington Street, Wheaton, Illinois.
- FIORE, ANDREW**, 5333 Germantown Avenue, Philadelphia, Pennsylvania.
- FISHER, THOMAS**, General Manager, Berwind White Coal Mining Company, 1100 Commercial Trust Building, Philadelphia, Pennsylvania.
- FITTS, JAMES LOGAN**, Mechanical Engineer, in care of Warren Webster and Company, 17th and Federal Streets, Camden, New Jersey.
- FITZ, E. M.**, Electrical Engineer, 58 East Dunlap Street, Worthington, Ohio.
- FITZGERALD, FRANCIS A. J.**, Consulting Engineer and President, The Fitzgerald Laboratories, Niagara Falls, New York.
- FITZMAURICE, WILLIAM J., Jr.**, Civil Engineer, 747 Marlyn Road, Philadelphia, Pennsylvania.
- FLANAGAN, CHARLES L.**, Insurance, Riverton, New Jersey.
- FLANAGAN, LOUIS A.**, Riverton, New Jersey.
- FLANDERS, RALPH E.**, Manager, Jones and Lamson Machine Company, and for mail, 41 Pleasant Street, Springfield, Vermont.
- FLEISHER, B. W.**, Manufacturer, 2301 Green Street, Philadelphia, Pennsylvania.
- FLEMING, FRANCIS P.**, Attorney-at-Law, 301 Heard Building, Jacksonville, Florida.
- FLETCHER, W. E.**, Technical Director, Atlas Powder Company, Wilmington, Delaware, and for mail, 4609 Osage Avenue, Philadelphia, Pennsylvania.
- FOLEY, JOHN GRAHAM**, Estimator, Brooklyn Edison Company, Brooklyn, New York, and for mail, 917 77th Street, Brooklyn, New York.
- FOOTE, ARTHUR DE WINT**, Civil Engineer, North Star Mines, Grass Valley, California.

- FORBES GEORGE**, Professor of Electrical Engineering, No. 11 Little College Street, Westminster, S. W., London, England.
- FORD, BRUCE**, Vice-President, Electric Storage Battery Company, 19th Street and Allegheny Avenue, Philadelphia, Pennsylvania.
- FORD, TERENCE J.**, Assistant Inspector of Ordnance, U. S. Navy, and for mail, 847 East Fourth Street, Bethlehem, Pennsylvania.
- FORREST, CHARLES N.**, 175 Elm Avenue, Rahway, New Jersey.
- FORSTALL, C. F.**, Assistant Supervisor, Division Engineer's Office, Reading, Pennsylvania.
- FORSTALL, WALTON**, Gas Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- FORTIER, MATTHEW L.**, Professor of Philosophy, College of the Holy Cross, Worcester, Massachusetts.
- FRANCIS, ISAAC H.**, Consulting Mechanical and Electrical Engineer, Otis Building, Philadelphia, Pennsylvania.
- FRANK, EDWIN**, Mechanical Engineer, 1015 Shepard Avenue, Milwaukee, Wisconsin.
- FRANKLIN, BENJAMIN**, Civil and Consulting Engineer, 906-907 Crozer Building, Philadelphia, Pennsylvania.
- FRAZIER, GEORGE H.**, Banker, P. O. Box 1630, Philadelphia, Pennsylvania.
- FRAZIER, W. W., Jr.**, Sugar Refiner, Lock Box 1630, Philadelphia, Pennsylvania.
- FREEMAN, HAROLD A.** (Retired), St. Davids, Pennsylvania.
- FREEMAN, W. W.**, President, The Union Gas and Electric Company, 4th and Plum Streets, Cincinnati, Ohio.
- FRERICHS, Dr. F. W.**, Vice-President, Herf and Frerichs Chemical Company, 4557 West Pine Boulevard, St. Louis, Missouri.
- FRETZ, E. S.**, Manufacturer, The Light Manufacturing and Foundry Company, Pottstown, Pennsylvania.
- FRIES, HAROLD H.**, Manufacturing Chemist, 92 Reade Street, New York City, New York.
- FRY, ANN W.**, 6433 Cherokee Street, Germantown, Philadelphia, Pennsylvania.
- FRYER, GEORGE G.**, Mechanical Engineer, 203 Onondaga Avenue, Syracuse, New York.
- FUGUET, HOWARD**, 560 Bullitt Building, 121-141 South 4th Street, Philadelphia, Pennsylvania.
- FULLER, GEORGE W.**, Consulting Engineer, 170 Broadway, New York City, New York.
- FULWEILER, W. H.**, Engineer, United Gas Improvement Company, 319 Arch Street, Philadelphia, Pennsylvania.
- FUNK, N. E.**, Electrical Engineer, 930 Wynnewood Road, Philadelphia, Pennsylvania.
- FURNESS, GEORGE W.**, Millville, New Jersey.
- FURNESS, HORACE HOWARD, Jr.**, Writer, 701 Stephen Girard Building, Philadelphia, Pennsylvania.
- FURNESS, RADCLIFFE**, Engineer of Research, Midvale Steel Company, 4300 Wissahickon Avenue, Philadelphia, Pennsylvania.
- GAGE, Dr. HENRY PHELPS**, Physicist, Chief, Optical Division, Corning Glass Works, and for mail, 212 Chemung Street, Corning, New York.
- GALLOWAY, C. D.**, Mechanical Engineer, Electric Storage Battery Company, and for mail, 8409 Anderson Street, Chestnut Hill, Philadelphia, Pennsylvania.
- GANGEWERE, E. P.**, Mechanical Supervisor, Reading Company, Reading, Pennsylvania.
- GARMAN, FRANK R.**, Electrical Engineer, 416 Seventh Avenue, Pittsburgh, Pennsylvania.
- GARRELS, W. L.**, Consulting Engineer (Kirkwood Route 13), Mason and Manchester Roads, St. Louis County, Missouri.
- GARRETT, J. L.**, Engineering Department, Bell Telephone Company, 261 North Broad Street, Philadelphia, Pennsylvania.
- GARRISON, F. LYNWOOD**, Mining Engineer, 1019 Clinton Street, Philadelphia, Pennsylvania.
- GARTLEY, WILLIAM H.**, Gas Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- GAZZAM, JOSEPH M.**, Retired Lawyer, 265 South 19th Street, Philadelphia, Pennsylvania.
- GERHARD, Dr. ARTHUR HOWELL**, Manufacturer and Instructor in Medicine, 1615 North Delaware Avenue, Philadelphia, Pennsylvania.
- GESELL, W. H.**, Chemical Engineer and Manager, Lehn and Fink, Incorporated, Bloomfield, New Jersey, and for mail, 235 Christopher Street, Montclair, New Jersey.
- GEST, WILLIAM P.**, President, Fidelity Trust Company, 327 Chestnut Street, Philadelphia, Pennsylvania.
- GETMAN, Dr. FREDERICK H.**, Chemist, Hillside Laboratory, Stamford, Connecticut.
- GFROERER, A. H.**, Engineer, 507 East Pearl Street, Cincinnati, Ohio.
- GHERRARDI, BANCROFT**, Engineer of Plant, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
- GIBBS, A. E.**, Chemist, Pennsylvania Salt Manufacturing Company, Widener Building, Philadelphia, Pennsylvania.
- GIBBS, E. L.**, Inspector, Interstate Commerce Commission, and for mail, 2004 Herschell Street, Jacksonville, Florida.
- GIBBS, WEBB L.**, Lubricating Engineer, 7734 South Shore Drive, Chicago, Illinois.
- GIBBS, WINFIELD S.**, American Engineering Company, 2001 East Cambria Street, Philadelphia, Pennsylvania.
- GIBSON, HENRY CLAY**, Treasurer, Bank of North America and Trust Company, Philadelphia, Pennsylvania, and for mail, Jenkintown, Pennsylvania.
- GIBSON, J. J.**, Vice-President, Westinghouse Commercial Investment Company, 150 Broadway, New York City, New York.
- GIESLER, JEAN V.**, Mechanical Engineer, The Fulton Company, Knoxville, Tennessee, and for mail, Box 834, Knoxville, Tennessee.
- GILCHRIST, JOHN F.**, Vice-President, Commonwealth Edison Company, Edison Building, Chicago, Illinois.

- GILL, JOHN D., Chemical Engineer, Atlantic Refining Company, 260 South Broad Street, Philadelphia, Pennsylvania.
- GILMAN, FRANKLIN W., 2027 Pine Street, Philadelphia, Pennsylvania.
- GILPIN, FRANCIS H., Gas Engineer, 22 Edgemont Avenue, Summit, New Jersey.
- GITTLESON, FRANK, Violinist, 1017 Spruce Street, Philadelphia, Pennsylvania.
- GLENDINNING, ROBERT E., Banker, Southeast Corner 15th and Chestnut Streets, Philadelphia, Pennsylvania.
- GLOVER, ROLFE E., Jr., Chemist, 2435 West 18th Street, Wilmington, Delaware.
- GODFREY, H. LINWOOD, Patent Solicitor, Electrical Engineer, 32 South Broad Street, Philadelphia, Pennsylvania.
- GOETZENBERGER, RALPH LEON, Electrical Engineer, Frankford Arsenal, Philadelphia, Pennsylvania.
- GOHEEN, J. P., Secretary, Brown Instrument Company, Wayne Junction, Philadelphia, Pennsylvania.
- GOLDBAUM, JACOB S., Research Chemist, 4234 Spruce Street, Philadelphia, Pennsylvania.
- GOLDSCHMIDT, V., Professor, Heidelberg University, and for mail, Gaisberg Strasse 9, Heidelberg, Germany.
- GOLDSMITH, EDWIN M., Manufacturer, Friedberger-Aaron Manufacturing Company, Logan Station, Philadelphia, Pennsylvania.
- GOMBERG, MOSES, Professor of Chemistry, 712 Onandago Street, Ann Arbor, Michigan.
- GOODSPEED, ARTHUR W., Professor of Physics, University of Pennsylvania, Philadelphia, Pennsylvania.
- GOODWIN, HAROLD, Jr., Electrical Engineer, 1817 Lindley Avenue, Philadelphia, Pennsylvania.
- GORDON, HUGH S., Mining Engineer, 10 Nevill Court, London, England.
- GOTTSCALK, OTTO, Civil Engineer, Casilla Correo 1723, Buenos Aires, South America.
- GRAFTON, E. H., Chief Chemist, Quaker City Rubber Company, Wissinoming, Philadelphia, Pennsylvania.
- GRAHAM, WALTER F., Chief Metallurgist, American Nickel Corporation, Clearfield, Pennsylvania.
- GRANBERRY, J. H., Civil Engineer, American Can Company, 234 West 21st Street, New York City, New York.
- GRAVELL, J. H., President, American Chemical Paint Company, Ambler, Pennsylvania.
- GREEN, GEORGE ROSS, Electrical Engineer, Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- GREENE, ARTHUR M., Jr., Professor of Mechanical Engineering, Princeton University, Princeton, New Jersey.
- GREENE, JOSEPH F., Chemical Engineer, Kimble Glass Company, Vineland, New Jersey.
- GREENWOOD, RICHARD, Acting Superintendent, 4520 Worth Street, Frankford, Philadelphia, Pennsylvania.
- GREENWOOD, TALMA TEMPLE, Research Engineer and Patent Solicitor, 40 Court Street Boston, Massachusetts, and for mail, East Templeton, Massachusetts.
- GREVEMEYER, GEORGE A., 122 South 13th Street, Philadelphia, Pennsylvania.
- GRIBBEL, JOHN, Gas Meter Manufacturer, 1513 Race Street, Philadelphia, Pennsylvania.
- GRIBBEL, W. GRIFFIN, Gas Meter Manufacturer, 1513 Race Street, Philadelphia, Pennsylvania.
- GRIEST, Major THOMAS H., Civil Engineer, The Bell Telephone Company of Pennsylvania, 261 North Broad Street, Philadelphia, Pennsylvania.
- GRIFFIN, FRANK H., Chief Chemist, Viscose Company, Marcus Hook, Pennsylvania.
- GRIFFITH, W. O., "The Clearing," Saundertown, Rhode Island.
- GRISSINGER, ELWOOD, Consulting Electrical and Mechanical Engineer, 293 Lexington Avenue, Buffalo, New York.
- GRISWOLD, ROBERT G., Director of Research, Henry L. Doherty and Company, 60 Wall Street, New York City, New York.
- GRONDAHL, L. O., Director of Research, Union Switch and Signal Company, Swisvale, Pennsylvania.
- GROSSCUP, HENRY ARTHUR, Salesman, Southeast Corner 5th and Chestnut Streets, Philadelphia, Pennsylvania.
- GUBELMAN, FREDERICK J., President, The Regina Company, and for mail, Woodland Avenue, Englewood, New Jersey.
- GUCKER, F. T., Civil Engineer and Contractor, 1450 Real Estate Trust Building, Philadelphia, Pennsylvania.
- GUDEMAN, Dr. EDWARD, Consulting Scientific Expert, 903 Postal Telegraph Building, Chicago, Illinois.
- GUTHRIE, BAYARD, R. F. D. No. 2, Ocean Springs, Mississippi.
- HAGAR, WALTER F., Jr., Manufacturer, The Hagar Company, Ambler, Pennsylvania.
- HAIGIS, CARLETON D., Research Physicist, Victor Talking Machine Company, Camden, New Jersey.
- HAINES, CASPAR WISTAR, Civil Engineer, 6026 Germantown Avenue, Philadelphia, Pennsylvania.
- HAINES, ROBERT B., Jr., Manufacturer of Rolling Mill Gauges and Haines' Automatic Micrometer, 156 West School Lane, Germantown, Philadelphia, Pennsylvania.
- HAINES, WILLIAM A., Manufacturer of Fancy Leather Goods, 238 Allen Lane, Mount Airy, Philadelphia, Pennsylvania.
- HALE, HENRY S., Address unknown.
- HALL, C. A., Chemical Engineer, 7951 Winston Road, Chestnut Hill, Philadelphia, Pennsylvania.
- HALL, GEORGE R., 311 Finance Building, Philadelphia, Pennsylvania.
- HALL, R. T., Rear-Admiral, U. S. N., P. O. Box 228, Wynnewood, Pennsylvania.

- HALLBERG, JOSEF HENRIK, Electrical Expert, 445 Riverside Drive, New York City, New York.
- HALSEY, WILLIAM B., Electrical Engineer, 27 Fairview Place, corner Church Avenue, Brooklyn, New York.
- HAMMER, EDWIN W., Consulting Engineer, 55 John Street, New York City, New York.
- HAMMER, WILLIAM J., Consulting Electrical Engineer, Hotel Earle, 103 Waverly Place, New York City, New York.
- HANTHORN, JOSEPH R., Mechanical Engineer, 4135 Girard Avenue, Philadelphia, Pennsylvania.
- HARRMAN, JOHN J., Mechanical Engineer, Walworth Manufacturing Company, Box 26, Boston, Massachusetts.
- HARRIS, A. J. B., The Ajax Metal Company, Frankford Avenue and Richmond Street, Philadelphia, Pennsylvania.
- HARRIS, BERT M., American Engineering Company, Philadelphia, Pennsylvania, and for mail, 5115 Hutchinson Street, Philadelphia, Pennsylvania.
- HARRIS, FRANKLIN M., Address unknown.
- HARRISON, ALFRED C., Retired Sugar Refiner, 1806 Packard Building, Philadelphia, Pennsylvania.
- HARRISON, Dr. CHARLES C. (Retired), 1520 Locust Street, Philadelphia, Pennsylvania.
- HARRISON, GEORGE L. (Retired), 1704 Locust Street, Philadelphia, Pennsylvania.
- HARRISON, J. K. M., Engineer, Harrison and Company, Land Title Building, Philadelphia, Pennsylvania.
- HARRISON, MITCHELL, Financier, Nokesville, Virginia.
- HARRISON, THOMAS RANDOLPH, Research Manager, The Brown Instrument Company, Philadelphia, Pennsylvania.
- HARRISON, WILLIAM W., Merchant, 119 North 11th Street, Philadelphia, Pennsylvania.
- HART, CHARLES, President, Delaware River Steel Company, Chester, Pennsylvania.
- HART, EDWARD, Professor of Chemistry, Lafayette College, Easton, Pennsylvania.
- HARTNESS, JAMES, President, Jones and Lamson Machine Company, and for mail, 30 Orchard Street, Springfield, Vermont.
- HARTUNG, ADOLPH, Paper Merchant, 506 Race Street, Philadelphia, Pennsylvania.
- HARTZEL, FRANCIS W., Carburetted Water Gas Manufacturer, 7039 Rising Sun Avenue, Philadelphia, Pennsylvania.
- HARVEY, RICHARD P., Engineering Specialties, 1212 Hildale Avenue, Sherman, Los Angeles County, California.
- HASCHKA, FERD. T., Watchmaker, Tiffany and Company, and for mail, 135 West 78th Street, New York City, New York.
- HATTON, T. CHALKLEY, Chief Engineer, Sewage Commission, City Hall, Milwaukee, Wisconsin.
- HAUPT, Professor LEWIS M., Consulting Engineer, Cynwyd, Pennsylvania.
- HAWKINS, J. DAWSON, Metallurgist, Colorado Springs, Colorado.
- HAYWARD, NATHAN, President, American Dredging Company, 308 Chestnut Street, Philadelphia, Pennsylvania.
- HAZEN, ALLEN, 23 West 43rd Street, New York City, New York.
- HEILMAN, D. B., Safety Engineer, P. O. Box 453, Reading, Pennsylvania.
- HEISER, C. E., Assistant Electrical Engineer, Reading Company, 501 Ritter Street, Reading, Pennsylvania.
- HEITMAN, EDWARD, Electrical Engineer, 156 Market Street, Newark, New Jersey.
- HELME, WILLIAM E., Manufacturer, 700 Bulletin Building, Philadelphia, Pennsylvania.
- HENDRICK, Dr. ELWOOD, Chemist, Author, 139 East 40th Street, New York City, New York.
- HENSON, EDWARD FRANCIS, Lumber Merchant, 921 North Delaware Avenue, Philadelphia, Pennsylvania.
- HEPBURN, Dr. JOSEPH SAMUEL, Associate Professor of Chemistry, Biological Chemist, Constantine Hering Laboratory, Hahnemann Medical College, 220 North Broad Street, Philadelphia, Pennsylvania.
- HERING, Dr. CARL, Consulting Electrical Engineer, 1317 Spruce Street, Philadelphia, Pennsylvania.
- HERING, WALTER E., President, The Globe Ticket Company, 112 North 12th Street, Philadelphia, Pennsylvania.
- HERR, EDWIN M., President, Westinghouse Electric and Manufacturing Company, Westinghouse Building, 150 Broadway, New York City, New York.
- HERRESHOFF, NATHANIEL G., Naval Architect and Marine Engineer, Herreshoff Manufacturing Company, Bristol, Rhode Island.
- HERSAM, ERNEST A., Professor of Metallurgy, University of California, Berkeley, California.
- HERSEY, MAYO D., Physicist, U. S. Bureau of Mines, 4800 Forbes Street, Pittsburgh, Pennsylvania.
- HERTY, Dr. CHARLES H., Chemist, 1 Madison Avenue, New York City, New York.
- HETZEL, FREDERIC V., Mechanical Engineer, P. O. Box 366, West Chester, Pennsylvania.
- HICKS, THOMAS W., Manufacturer of Farm Implements, 4516 Fremont Avenue, South Minneapolis, Minnesota.
- HIERGESELL, VALENTINE, Scientific Instrument Maker, 2207-2213 Bellevue Avenue, Philadelphia, Pennsylvania.
- HIGGINS, EDMUND SAFFORD, General Manager, Yellow Cab Company, 1734 North Broad Street, Philadelphia, Pennsylvania.
- HILL, ROY LINDEN, Chemist, Atlas Powder Company, Tamaqua, Pennsylvania.
- HINRICH, HANS, President, The Hans Hinrich Chemical Corporation, 227 Fulton Street, New York City, New York.
- HIRES, CHARLES E., Manufacturing Chemist, 206 South 24th Street, Philadelphia, Pennsylvania.

- SPENCER, FRANK HERRERY**, President, Metal and Thermit Corporation, 120 Broadway, New York City, New York.
- SPENCER, Dr. FANNY R. M.**, 37 Maple Avenue, Warwick, New York.
- SPENCER, ALFRED B.**, Research Chemist, 33 West 60th Street, New York City, New York.
- SPINDLEY, ANTHONY de H.**, Instructor of Civil Engineering, Union College, Schenectady, New York.
- SPINDLEY, Dr. GEORGE A.**, Secretary to Committee on Science and the Arts, The Franklin Institute, Philadelphia, Pennsylvania, and for mail, Swarthmore, Pennsylvania.
- SPINNETTER, GEORGE**, Blank Book Maker, Lithographer, 247-253 South American Street, Philadelphia, Pennsylvania.
- SPILLARD, WALTER E.**, Research Engineer, Philadelphia Storage Battery Company, Ontario and C Streets, Philadelphia, Pennsylvania.
- SPILLARD, CHARLES S.**, Chemist and Chemical Engineer, in care of Rohm and Haas Company, Bristol, Pennsylvania.
- SPILLER, S. C.**, Consulting Engineer, 311 Elm Avenue, Swarthmore, Pennsylvania.
- SPURGES, GEORGE R.**, Technical Journalist, 135 Garrison Avenue, Jersey City, New Jersey.
- SPURGE, L. J. R.**, Mechanical Engineer, 26 Howard Road, Brookline, Upper Darby Post Office, Delaware County, Pennsylvania.
- SPURGE, FRANCIS T.**, Lawyer, Riderwood, Maryland.
- SPURGEON, E. KARL**, Electrical Engineer, Development and Research Department, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
- SPURGE, SAMUEL C.**, Chemist and Sugar Refiner, 82 Remsen Street, Brooklyn, New York.
- SPURGE, ERNEST L.**, Mechanical Engineer, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- SPURGE, Dr. DAVID W.**, 616 Montgomery Avenue, Bryn Mawr, Pennsylvania.
- SPURGE, FRANKLIN S.**, Lunch Room Proprietor, 1515 Arch Street, Philadelphia, Pennsylvania.
- SPURGE, JOHN W.**, Consulting Engineer, "The Oakes," Norton-by-Sheffield, England.
- SPURGE, ROBERT E.**, Consulting Hydraulic Engineer, R. F. D. No. 1, Voorheesville, New York.
- SPURGE, WILLIAM**, Chemist, Room 2009-2011 West Monroe Street, Chicago, Illinois.
- STOUSTON, JOHN J. L.**, Civil Engineer, Department of City Transit, 1211 Chestnut Street, Philadelphia, Pennsylvania, and for mail, 137 North 19th Street, Philadelphia, Pennsylvania.
- STOUSTON, SAMUEL F.**, Trustee, 512 Real Estate Trust Building, Philadelphia, Pennsylvania.
- STOWARD, A. C.**, Gas Engineer, 61 Broadway, New York City, New York.
- STOWARD, WILFRED**, Instructor in Physics, Academy of the New Church, Bryn Athyn, Pennsylvania.
- STOWE, ARTHUR W.**, Broker, 1811 Walnut Street, Philadelphia, Pennsylvania.
- STOWELL, JOHN W.**, Engineer, Lamp Works, General Electric Company, Harrison, New Jersey.
- STOWER, Professor HARRY S.**, Physicist, Carnegie Institute of Technology, and for mail, 5709 Solway Street, Pittsburgh, Pennsylvania.
- STOWSON, CHARLES HENRY**, Patent Solicitor and Engineer, 32 South Broad Street, Philadelphia, Pennsylvania.
- STOWSON, MISS EMILY E.**, Instructor in Physics, Agnes Scott College, Decatur, Georgia.
- STOWSON, HENRY**, Patent Solicitor and Engineer, West End Trust Building, Philadelphia, Pennsylvania.
- STOWSON, RICHARD**, 32 South Broad Street, Philadelphia, Pennsylvania.
- HUFF, ERNEST L.**, Commercial Manager, Monongahela West Pennsylvania Public Service Company, Fairmont, West Virginia, and for mail, 517 Coleman Avenue, Fairmont, West Virginia.
- HUMMEL, WILLARD A.**, American Engineering Company, 5049 Hawthorne Street, Philadelphia, Pennsylvania.
- HUMPHREYS, ALEXANDER C.**, Consulting Engineer, President, Stevens Institute of Technology, Hoboken, New Jersey.
- HUMPHREYS, Dr. W. J.**, Physicist, Weather Bureau, Washington, D. C.
- HUSTON, CHARLES L.**, Vice-President, Lukens Steel Company, Coatesville, Pennsylvania.
- HUTCHINSON, S. PEMBERTON**, President, Westmoreland Coal Company, 224 South 3rd Street, Philadelphia, Pennsylvania.
- HUTTINGER, W. R.**, Mechanical Engineer, 86 East Greenwood Avenue, Lansdowne, Pennsylvania.
- HYATT, CLINTON BROWN**, Radio Experimenter, Melrose Park, Pennsylvania.
- INDAHL, MAURITZ C.**, Mechanical Engineer, 248 East Johnson Street, Philadelphia, Pennsylvania.
- INGERSOLL, CHARLES EDWARD**, Attorney-at-Law, President, Central National Bank, 5th and Chestnut Streets, Philadelphia, Pennsylvania.
- INSULL, SAMUEL**, President, Commonwealth Edison Company, 72 West Adams Street, Chicago, Illinois.
- IRISH, WILLIAM MITCHELL**, Vice-President and General Manager, The Atlantic Refining Company, 260 South Broad Street, Philadelphia, Pennsylvania.
- IRONS, ROBERT HATFIELD**, President, Central Iron and Steel Company, Harrisburg, Pennsylvania.
- ISRAEL, JOSEPH D.**, District Manager, The Philadelphia Electric Company, 10th and Chestnut Streets, Philadelphia, Pennsylvania.
- ITTNER, MARTIN HILL**, Chief Chemist, Colgate and Company, Jersey City, New Jersey.
- IVES, FRED E.**, Inventor, 1808 North Park Avenue, Philadelphia, Pennsylvania.
- IVES, Dr. HERBERT E.**, Physicist, in care of Western Electric Company, 463 West Street, New York City, New York.
- JACKSON, Dr. JOHN PRICE**, Room 702, New York Edison Company, Irving Place and 15th Street, New York City, New York.

- JACKSON, WILLIAM STEELL**, Patent Attorney, 1001 Chestnut Street, Philadelphia, Pennsylvania.
- JACOBUS, D. S.**, Advisory Engineer, The Babcock and Wilcox Company, 85 Liberty Street, New York City, New York.
- JAMES, WILLIAM FOY**, Manager, Industrial Division Philadelphia Office, Westinghouse Electric and Manufacturing Company, and for mail, 6920 Boyer Street, Mount Airy, Philadelphia, Pennsylvania.
- JEANES, ISAAC W.**, Room 908, Lafayette Building, Philadelphia, Pennsylvania.
- JEFFERSON, J. P.**, Manufacturer, P. O. Box 645, Santa Barbara, California.
- JEFFERIES, ZAY**, Consulting Metallurgist, Aluminum Company of America, 2210 Harvard Avenue, Cleveland, Ohio.
- JENKINS, C. FRANCIS**, Inventor, 5502 16th Street, N. W., Washington, D. C.
- JENKINS, THEODORE F.**, Attorney-at-Law, 1100 Liberty Building, Broad and Chestnut Streets, Philadelphia, Pennsylvania.
- JENNINGS, W. N.**, Business Photographer, Smith Building, 18th and Market Streets, Philadelphia, Pennsylvania.
- JOB, ROBERT**, Vice-President, Milton Hersey Company, Limited, 84 St. Antoine Street, Montreal, Quebec, Canada.
- JODIDI, Dr. SAMUEL L.**, Chemist, U. S. Department of Agriculture, Washington, D. C.
- JOHANSEN, ERNST**, Chemist, New England Oil Refining Company, Fall River, Massachusetts.
- JOHNSON, CLARENCE NATHAN**, Electrical Engineer, Westinghouse Electric and Manufacturing Company, 30th and Walnut Streets, Philadelphia, Pennsylvania.
- JOHNSON, ERNEST EDWARD**, Professor of Physics, Northeast High School, Philadelphia, Pennsylvania, and for mail, 5850 North 6th Street, Philadelphia, Pennsylvania.
- JOHNSON, JAMES CURTIS**, General Superintendent of Telegraph, Pennsylvania Railroad Company, 812 Fox Building, Philadelphia, Pennsylvania.
- JOHNSON, WALTER H.**, First Vice-President, Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- JOHNSON, WILLIAM A.**, President, Williams, Brown and Earle, 918 Chestnut Street, Philadelphia, Pennsylvania.
- JOHNSTON, JOHN**, Chemist, Sterling Laboratory, Yale University, New Haven, Connecticut.
- JONES, JONATHAN**, Engineer, P. O. Box 1593, Pittsburgh, Pennsylvania.
- JONES, JULIAN D.**, Superintendent, Telegraph and Signals, Eastern Region, Pennsylvania System, Room 152, Broad Street Station, Philadelphia, Pennsylvania.
- JONES, PHILIP CHAPIN**, Electrical Engineer, Goodyear Tire and Rubber Company, Akron, Ohio, and for mail, 514 Barwell Street, Akron, Ohio.
- JONES, W. CLYDE**, Attorney-at-Law, 77 West Washington Street, Chicago, Illinois.
- JUNKERSFELD, PETER**, Engineering and Construction, 68 Trinity Place, New York City, New York.
- JUSTI, HENRY M.**, 32nd and Spring Garden Streets, Philadelphia, Pennsylvania.
- KABAKJIAN, Dr. D. H.**, Assistant Professor of Physics, University of Pennsylvania, Philadelphia, Pennsylvania.
- KALTENTHALER, H. J.**, Manufacturer of Steam Specialties, 6457 Woodbine Avenue, Overbrook, Philadelphia, Pennsylvania.
- KARRER, ENOCH**, Physicist, National Lamp Works of General Electric Company, Wire Division, 1770 East 45th Street, Cleveland, Ohio.
- KAUFMANN, HERBERT M.**, Vice-President, Mutual Chemical Company of America, 270 Madison Avenue, New York City, New York.
- KAVANAUGH, WM. H.**, Professor of Experimental Engineering, Towne Scientific School, University of Pennsylvania, Philadelphia, Pennsylvania.
- KEEFER, WILLIAM B.**, Address unknown.
- KEITH, C. P.**, in care of W. G. Peters, 69 Van Antwerp Road, Schenectady, New York.
- KELLER, E. E.**, Engineer and Manufacturer, Braywood, Quarton Road, Birmingham, Michigan.
- KELLER, HARRY HEXAMER**, Engineer, Jenkintown, Pennsylvania.
- KELLERS, CHARLES FREDERICK**, 117 North Terrace, Schenectady, New York.
- KELLEY, Dr. GEORGE L.**, Research Chemist, 6804 McCallum Street, Philadelphia, Pennsylvania.
- KELLOGG, HOSFORD D.**, Manager, The H. B. Smith Company, 17th and Arch Streets, Philadelphia, Pennsylvania.
- KENNEDY, FRANK G., Jr.**, President, Logan Iron and Steel Company, 1218 Stephen Girard Building, and for mail, 2043 Spruce Street, Philadelphia, Pennsylvania.
- KENNEDY, JOHN H.**, Address unknown.
- KENNEDY, J. J.**, Consulting Engineer, 52 Broadway, New York City, New York.
- KENNEDY, M. C.**, Vice-President, Pennsylvania Railroad Company, Broad Street Station, Philadelphia, Pennsylvania.
- KENNELLY, Dr. A. E.**, Professor of Electrical Engineering, Harvard University, Cambridge, Massachusetts.
- KENT, A. ATWATER**, Manufacturer, Ardmore, Pennsylvania.
- KENT, S. LEONARD, Jr.**, Hydro-Electrics, Manayunk, Philadelphia, Pennsylvania.
- KERCHER, M. A.**, Commercial Department, Bell Telephone Company, 1230 Arch Street, Philadelphia, Pennsylvania.
- KERLIN, W. D.**, Secretary and Treasurer, Camden Forge Company, Camden, New Jersey.
- KERR, WILLIAM M.**, Manufacturer, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- KETCHAM, O. W.**, Manufacturer of Architectural Terra Cotta, 125 North 18th Street, Philadelphia, Pennsylvania.
- KETTERLINUS, J. L.**, Lithographer, 4th and Arch Streets, Philadelphia, Pennsylvania.
- KILPATRICK, J. L.**, Fulton Towers, 78 Harrison Street, East Orange, New Jersey.

- KIMBER, WILLIAM, M. C.**, Manufacturer of Electrical Instruments, Sword and Kimber Company, 4861 Stenton Avenue, Philadelphia, Pennsylvania.
- KINEALY, JOHN HENRY**, Consulting Engineer, 503 Granite Building, St. Louis, Missouri.
- KING, CHARLES W. G.**, Mechanical Engineer, 6201 Park Boulevard, Wildwood Crest, New Jersey.
- KING, JOSEPH B., Jr.**, Assistant in Research Laboratory, Electric Storage Battery Company, and for mail, 7315 Boyer Street, Mount Airy, Philadelphia, Pennsylvania.
- KINGSBURY, Dr. EDWIN F.**, Physicist, Western Electric Company, 463 West Street, New York City, New York.
- KINGSFORD, RUSSELL T.**, 808 Glenside Avenue, Wyncote, Pennsylvania.
- KINNARD, L. H.**, President, The Bell Telephone Company, 1631 Arch Street, Philadelphia, Pennsylvania.
- KINNIER, GEORGE E.**, Civil Engineer, 464 North New Street, Bethlehem, Pennsylvania.
- KIPPENBERG, HENRY**, in care of Merck and Company, Rahway, New Jersey.
- KIRK, C. J.**, President, United States Sherardizing Company, New Castle, Pennsylvania.
- KIRSOPP, EDGAR C. B.**, Assistant Treasurer, Rohm and Haas Company, Inc., Bristol, Pennsylvania, and for mail, 40 North Front Street, Philadelphia, Pennsylvania.
- KISTLER, S. S.**, Professor of Chemistry, College of the Pacific, Stockton, California.
- KLAUDER, R.**, Plant Department, The Bell Telephone Company, 6114 North 20th Street, Philadelphia, Pennsylvania.
- KLEMM, J. GEORGE, Jr.**, Heating and Ventilating Engineer, Box 284, Haverford, Pennsylvania.
- KLINE, C. MAHLON**, Wholesale Druggist, 105 North 5th Street, Philadelphia, Pennsylvania.
- KLUMPP, JOHN BARTLEMAN**, Inspecting Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- KNAPP, ARTHUR**, Petroleum Engineer, Box 1902, Philadelphia, Pennsylvania.
- KNAPP, I. N.**, Engineer, 504 Aspen Street, N. W., Tacoma Park, Washington, D. C.
- KNEASS, STRICKLAND L.**, Mechanical Engineer, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- KNOEDLER, E. L.**, General Superintendent, The Welshbach Company, Gloucester, New Jersey.
- KNOX, HENRY HOBART**, Mining Engineer, 160 Broadway, New York City, New York.
- KOCH, GEORGE B.**, General Foreman, South Altoona Foundries, Pennsylvania Railroad Company, Altoona, Pennsylvania.
- KOCH, JULIUS A.**, Professor of Chemistry and Dean of School of Pharmacy, University of Pittsburgh, Bluff and Pride Streets, Pittsburgh, Pennsylvania.
- KOHN, JOSEPH**, Secretary and Treasurer, Universal Dental Company, 5416 Woodcrest Avenue, Philadelphia, Pennsylvania.
- KOTHNY, G. L.**, Consulting Engineer, C. H. Wheeler Manufacturing Company, and for mail Woodland Road, Strafford, Pennsylvania.
- KRAMER, D. F.**, Signal Foreman, Atlantic Railroad, Reading Company, Camden, New Jersey.
- KRANZ, FRED WILLIAM**, Research Physicist, Geneva, Illinois.
- KRAUS, C. R.**, Engineering Department, Bell Telephone Company, 261 North Broad Street, Philadelphia, Pennsylvania.
- KREBS, A. S.**, President, Krebs Pigment and Chemical Company, Newport, Delaware.
- KREBS, H. J.**, Chairman, Board of Directors, Krebs Pigment and Chemical Company, Newport, Delaware.
- KRISCHKER, Mrs. R. H.**, Address unknown.
- KUCHER, ANDREW ALBERT**, Consulting Engineer, Westinghouse Electric and Manufacturing Company, South Philadelphia, Pennsylvania, and for mail, 812 Glen Terrace, Chester, Pennsylvania.
- KUEHN, THEODORE**, 3232 North 26th Street, Philadelphia, Pennsylvania.
- KUESEL, Dr. GEORGE C.**, Dentist, 1614 Locust Street, Philadelphia, Pennsylvania.
- KUHN, C. HARTMAN**, 202 Liberty Building, Philadelphia, Pennsylvania.
- KUNSMAN, CHARLES H.**, Physicist, Fixed Nitrogen Research Laboratory, U. S. Department of Agriculture, Washington, D. C.
- KUNZ, Dr. GEORGE F.**, President, The American Scenic and Historic Preservation Society, 409 Fifth Avenue, New York City, New York.
- KUTTROFF, EDWIN**, President, Verona Chemical Company, North Newark, New Jersey.
- LAIRD, CLINTON N.**, Chemist, Canton Christian College, Canton, China.
- LAMB, NEWTON**, Chemist, Penn Process Company, Incorporated, Mill and Church Roads, Elkins Park, Pennsylvania, and for mail, 349 Harrison Avenue, Elkins Park, Pennsylvania.
- LANDRETH, C. P.**, Manufacturer, Electrolytic Purification Company, 15th Street and Lehigh Avenue, Philadelphia, Pennsylvania.
- LANZA, GAETANO**, Engineer, Special Consultant, The Baldwin Locomotive Works, Philadelphia, Pennsylvania, and for mail, 5624 Cedar Avenue, Philadelphia, Pennsylvania.
- LATHROP, ELBERT CLYDE**, Chemist, The Celotex Company, 645 North Michigan Avenue, Chicago, Illinois.
- LAUER, CONRAD**, General Manager, Day and Zimmermann, and for mail, 233 West Hottter Street, Germantown, Philadelphia, Pennsylvania.
- LAVINO, E. J.**, Merchant, 471 Bullitt Building, Philadelphia, Pennsylvania.
- LAWALL, CHARLES H.**, Analytical Chemist, 636 Franklin Square, Philadelphia, Pennsylvania.
- LAWLER, G. S.**, Electrical Engineer, Associated Factory Mutual Fire Insurance Companies, Fort Hill Square, 184 High Street, Boston, Massachusetts.
- LAWRENCE, RUSSELL E.**, Dean of Engineering, University of Detroit, 630 East Jefferson Avenue, Detroit, Michigan.
- LAY, JOHN TRACY**, Research Assistant in Physics, University of Pennsylvania, and for mail, 4015 Pine Street, Philadelphia, Pennsylvania.

- LE BOUTILLIER, HENRY W., Chemist, Wayne, Pennsylvania.
 LE BOUTILLIER, ROBERT, Wayne, Pennsylvania.
 LEDOUX, J. W., Chief Engineer, American Pipe Manufacturing Company, 112 North Broad Street, Philadelphia, Pennsylvania.
 LEE, ELISHA, Vice-President in Charge of Operation, Broad Street Station, Philadelphia, Pennsylvania.
 LEE, JAMES D., Jr., 5929 Greene Street, Germantown, Philadelphia, Pennsylvania.
 LEE, WALTER T., Accountant, 308 Rex Avenue, Chestnut Hill, Philadelphia, Pennsylvania.
 LEECH, THOMAS DAVID JAMES, Civil Engineer, P. N. R. School, University of Sydney, New South Wales, Australia, and for mail, "Orontes," Clark Street, Granville, New South Wales, Australia.
 LEEDS, MORRIS E., Manufacturer of Scientific Instruments, 4901 Stenton Avenue, Germantown, Philadelphia, Pennsylvania.
 LEFFMANN, HENRY, Chemist, The Franklin Institute, Philadelphia, Pennsylvania.
 LEIGHNINGER, WILLIAM B., Teacher of Chemistry, Frankford High School, and for mail, 236 West School Lane, Germantown, Philadelphia, Pennsylvania.
 LE MAISTRE, F. J., Chemical Engineer, 810 Bellevue Court Building, Philadelphia, Pennsylvania.
 LEMOINE, L. R., President, United States Cast Iron Pipe and Foundry Company, Morris Building, Philadelphia, Pennsylvania.
 LENHER, VICTOR, Chemist, 1718 Summit Avenue, Madison, Wisconsin.
 LENKER, WILL G., Civil Engineer, 405 Chestnut Street, Sunbury, Pennsylvania.
 LESLEY, ROBERT W., Manufacturer, 612 Pennsylvania Building, Philadelphia, Pennsylvania.
 LEVY, HOWARD S., 1424 North 15th Street, Philadelphia, Pennsylvania.
 LEVY, LIONEL FARADAY, Chemical Engineer, Manager, Repro Art Machinery Company, and for mail 220 West Roberts Avenue, Philadelphia, Pennsylvania.
 LEVY, MAX, Manufacturer and Photo-Engraver, 600 West 115th Street, New York City, New York.
 LEWIS, A. NELSON, Attorney-at-Law, 1811 Walnut Street, Philadelphia, Pennsylvania.
 LEWIS, DANIEL C., Agent, The Millville Manufacturing Company, Millville, New Jersey.
 LEWIS, GEORGE W., Mechanical Engineer, National Advisory Committee for Aeronautics, 2722 Navy Building, Washington, D. C.
 LEWIS, HOWARD W., Banker, 1928 Spruce Street, Philadelphia, Pennsylvania.
 LEWIS, JOHN F., Attorney-at-Law, 208 South 4th Street, Philadelphia, Pennsylvania.
 LEWIS, NATHAN E., Mechanical Engineer, Babcock and Wilcox Company, 85 Liberty Street, New York City, New York.
 LEWIS, PAUL A., Physician, Rockefeller Institute for Medical Research, Department of Animal Pathology, Princeton, New Jersey.
 LEWIS, ROBERT B., Mechanical Engineer, 51 East Penn Street, Germantown, Philadelphia, Pennsylvania.
 LEWIS, WILFRED, Mechanical Engineer, President, The Tabor Manufacturing Company, and for mail, Rose Lane, Haverford, Pennsylvania.
 LICHTENBERG, Captain CHESTER, Electrical Engineer, 136 Waverly Place, Schenectady, New York.
 LIDBURY, FRANK AUSTIN, President, Oldbury Electro-Chemical Company, P. O. Box 619, Niagara Falls, New York.
 LIEB, J. W., Vice-President, The New York Edison Company, 15th Street and Irving Place, New York City, New York.
 LIEBER, HUGO, Chemist, President, H. Lieber and Company, 19 West 44th Street, New York City, New York.
 LIGHTFOOT, THOMAS M., Retired Educator, Chesham, New Hampshire.
 LIHME, I. P., Chemical Engineer, The Grasselli Chemical Company, Cleveland, Ohio.
 LILLEBRIDGE, H. W., 402 West Safford Street, Philadelphia, Pennsylvania.
 LILLIE, LEWIS, Vice-President, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
 LILLIE, S. MORRIS, President, Sugar Apparatus Refining Company, 4804 Springfield Avenue, Philadelphia, Pennsylvania.
 LINDENTHAL, GUSTAV, Consulting Engineer, Room 738, Pennsylvania R. R. Station, New York City, New York.
 LIPPINCOTT, J. BERTRAM, Publisher, 227 South 6th Street, Philadelphia, Pennsylvania.
 LIPPINCOTT, JOSEPH W., Publisher, Bethayres, Pennsylvania.
 LITTLE, ARTHUR D., President, Arthur D. Little, Incorporated, 30 Charles River Road, Cambridge, Massachusetts.
 LIVERSIDGE, HORACE P., Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
 LIVINGSTON, HERMAN, Hydro Carbon Engineer, Calco Chemical Company, Richards Park, Somerville, New Jersey.
 LLEWELLYN, W. H., Druggist, 1518 Chestnut Street, Philadelphia, Pennsylvania.
 LLOYD, HERBERT, President, Electric Storage Battery Company, Philadelphia, Pennsylvania.
 LLOYD, JOHN URI, Manufacturing Pharmacist and Chemist, Clifton and Lafayette Avenues, Cincinnati, Ohio.
 LLOYD, MORTON G., Electrical Engineer, Bureau of Standards, Washington, D. C.
 LOBBEN, PEDER, Mechanical Engineer, Room No. 2, Keyers Gade 1, Kristiania, Norway.
 LOEB, LEO, Mechanical Engineer, Albert B. Manuel, 61 Broadway, New York City, New York, and for mail, 302 Park Street, Montclair, New Jersey.
 LOHMANN, ALFRED PERKINS, Engineer, 15 Railroad Avenue, Haverford, Pennsylvania.
 LONERGAN, J. E., Brass Manufacturer, 211 Race Street, Philadelphia, Pennsylvania.
 LONGSTRETH, CHARLES, 611 A Avenue, Coronado, California.

- LONGSTRETH, EDWARD T.**, Manufacturer, 6805 North 11th Street, Oak Lane, Philadelphia, Pennsylvania.
- LORENTZ, HENDRIK A.**, Physicist, Zylweg 76, Haarlem, Holland.
- LOSS, HENRIK von ZERNIKOW**, Consulting Engineer, Hotel Bristol, Kristiania, Norway.
- LOVEJOY, J. R.**, Vice-President, General Electric Company, Schenectady, New York.
- LOVEKIN, LUTHER D.**, Marine Engineer, 360 Penn Road, Wynnewood, Pennsylvania.
- LOWE, ARTHUR W.**, Public School Teacher, 1224 Herbert Street, Frankford, Philadelphia, Pennsylvania.
- LOWER, NATHAN M.**, Assistant General Manager, Locomotive Stoker Company, 292 Balph Avenue, Bellevue, Pennsylvania.
- LOYD, SARAH A. C.**, 1206 Filbert Street, Philadelphia, Pennsylvania.
- LUCAS, FRANCIS F.**, Engineer, Bell Telephone Laboratories, Incorporated, 463 West Street, New York City, New York.
- LUCKE, CHARLES EDWARD**, Professor of Mechanical Engineering, Columbia University, New York City, New York.
- LUCKIESH, Dr. M.**, Director of Applied Science, Nela Research Laboratories, Nela Park, Cleveland, Ohio.
- LUKENS, Dr. HIRAM S.**, Chemist, Harrison Laboratory, University of Pennsylvania, 34th and Spruce Streets, Philadelphia, Pennsylvania.
- LUPTON, EDWARD**, Manufacturer of Sheet Metal, Allegheny Avenue and Tulip Street, Philadelphia, Pennsylvania.
- LYMAN, JAMES**, Consulting Engineer, Member of Firm, Sargent and Lundy, 1412 Edison Building, Chicago, Illinois.
- LYNCH, JOHN COOPER**, Assistant Vice-President, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
- LYON, PERCY S.**, Chief Engineer, Cochrane Corporation, 17th Street and Allegheny Avenue, Philadelphia, Pennsylvania.
- LYSLE, FREDERIC BOWERS**, Chemist-Engineer, 906 Colonial Trust Building, Philadelphia, Pennsylvania.
- MALLISTER, T. S.**, Commercial Department, The Bell Telephone Company, 261 North Broad Street, Philadelphia, Pennsylvania.
- MARTHUR, GEORGE P.**, Mechanical Engineer, Joseph Oat and Sons, 232 Quarry Street, Philadelphia, Pennsylvania.
- MCBRIDE, THOS. C.**, Sales Manager, Worthington Pump and Machinery Corporation, 1516 North American Building, Philadelphia, Pennsylvania.
- MCCALL, GEORGE**, Address unknown.
- MCCALL, RICHARD C.**, 2115 Locust Street, Philadelphia, Pennsylvania.
- MCCLENAHAN, JOHN MEGREDDY, and**, Montgomery Avenue, Villanova, Pennsylvania.
- MCCONNELL, FRANKLIN P.**, Day and Zimmermann, Incorporated, 1600 Walnut Street, Philadelphia, Pennsylvania, and for mail, 706 Spruce Street, Philadelphia, Pennsylvania.
- MCCORMACK, H.**, Professor of Chemical Engineering, Armour Institute of Technology, Chicago, Illinois.
- MCCORMICK, WILLIAM**, Assistant Engineer, Reading Company, Reading Terminal, Philadelphia, Pennsylvania.
- MCDONALD, HUNTER**, Chief Engineer, N. C. and St. L. Ry. Company, 924 Broadway, Nashville, Tennessee.
- MCDOWELL, CHARLES**, Paper Manufacturer, Main and Levering Streets, Manayunk, and for mail, 5804 Greene Street, Germantown, Philadelphia, Pennsylvania.
- McFADDEN, GEORGE H.**, Merchant, 121 Chestnut Street, Philadelphia, Pennsylvania.
- MCGEORGE, PERCY**, 711 Bullitt Building, Philadelphia, Pennsylvania.
- McGOWAN, J. Jr.**, Assistant General Manager, Campbell Soup Company, 2nd and Market Streets, Camden, New Jersey.
- McKAIG, W. WALLACE**, Mechanical Engineer, Cumberland, Maryland.
- McKEEHAN, Dr. L. W.**, Research Physicist, Western Electric Company, 463 West Street, New York City, New York.
- McLEAN, WILLIAM L.**, Publisher, The Evening Bulletin, Philadelphia, Pennsylvania.
- McMEEKIN, Major C. W.**, 343 Rialto Building, San Francisco, California.
- McVEY, JOHN JOSEPH**, Publisher and Bookseller, 1229 Arch Street, Philadelphia, Pennsylvania.
- MACALPINE, J. KENNETH, W.**, Chemistry Teacher, New York University, Washington Square, and for mail, Box 39, Hartley Hall, Columbia University, New York City, New York.
- MacBAIN, D. R.**, Assistant General Manager, New York Central Railroad Company, Cleveland, Ohio.
- MacBETH, NORMAN**, Illuminating Engineer, 227 West 17th Street, New York City, New York.
- MacGREGOR, FRANK S.**, Development Department, E. I. du Pont de Nemours and Company, 452 Du Pont Building, Wilmington, Delaware.
- MACKENZIE, K. G.**, Consulting Chemist, The Texas Company, 17 Battery Place, New York City, New York.
- MacLEAN, GEORGE**, President, Ives Inventions, Port Washington, New York.
- MacLEAN, L. W.**, Electrical Supervisor, Reading Company, Reading, Pennsylvania.
- MADEIRA, PERCY C.**, Coal Operator, North American Building, Philadelphia, Pennsylvania.
- MAILLOUX, Dr. C. O.**, Consulting Engineer, 111 Fifth Avenue, New York City, New York.
- MAIZLISH, Dr. ISRAEL**, Instructor in Physics, Centenary College, Shreveport, Louisiana.
- MALLINCKRODT, E., Jr.**, Manufacturing Chemist, Mallinckrodt Chemical Works, St. Louis, Missouri.
- MANKER, FORREST WILLIAM**, Vice-President, Senferer Combustion Company, 366 Gerald Avenue, New York City, New York.

- MANNING, EUGENE REYNOLDS**, Chemical Engineer, Harrison Laboratory, University of Pennsylvania, Philadelphia, and for mail, 32 West Ridley Avenue, Ridley Park, Pennsylvania.
- MANWARING, ALBERT H.**, Electrical Engineer, The Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- MARBAKER, Dr. EDWARD**, Chemist, Mellon Institute, Pittsburgh, Pennsylvania.
- MARCONI, GUGLIELMO**, Senator, Electrical Engineer and Inventor, 31 Via Garibaldi Gianicolo, Rome, Italy.
- MARKLE, A.**, Mining Engineer, Hazleton, Pennsylvania.
- MARTIN, THOMAS S., 3rd**, Civil Engineer, 7205 Cresheim Road, Germantown, Philadelphia, Pennsylvania.
- MARTOCCELLO, JOSEPH A.**, Manufacturer Raw Water Ice Making Appliances, 229 North 13th Street, Philadelphia, Pennsylvania.
- MASLAND, CHARLES H., 2nd**, Chemical Engineer, 1128 Foulkrod Street, Frankford, Philadelphia, Pennsylvania.
- MASON, CHARLES THOMAS**, Electrical Engineer, President, Sumter Electric Company, Sumter, South Carolina.
- MASON, SIDNEY**, President, Welsbach Company, Gloucester City, New Jersey.
- MASON, W. P.**, Professor of Chemistry, Rensselaer Polytechnic Institute, Troy, New York.
- MASTERS, Major FRANK M.**, Consulting Engineer, Calder Building, Harrisburg, Pennsylvania.
- MATHEWS, Dr. JOSEPH HOWARD**, Professor in Chemistry, University of Wisconsin, Madison, Wisconsin.
- MATTHEWS, W. G.**, Address unknown.
- MATUNAGA, YOSINOBU**, Physicist, Shibaura Engineering Works, Kanasugi, Shiba, Tokyo, Japan.
- MAXFIELD, H. H.**, General Superintendent, Pennsylvania System, 402 Pennsylvania Building, Wilmington, Delaware.
- MAYER, NELSON B.**, Merchant, Hotel Marie Antoinette, Broadway and 67th Street, New York City, New York.
- MEASEY, WILLIAM MAUL**, Attorney-at-Law, 1328 Chestnut Street, Philadelphia, and for mail, Box 208, Haverford, Pennsylvania.
- MEEKER, G. H.**, Professor of Chemistry, School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania.
- MEES, C. E. K.**, Director of Research, Eastman Kodak Company, Kodak Park Works, Rochester, New York.
- MELCHER, WM. C., Jr.**, care of I. P. Morris Department, William Cramp and Sons Ship and Engine Building Company, Philadelphia, Pennsylvania.
- MELLOR, NORMAN**, Manufacturer, Wayne Junction, Philadelphia, Pennsylvania.
- MELODY, MICHAEL**, Bailey Building, Philadelphia, Pennsylvania.
- MERRICK, JAMES HARTLEY**, Acting Vice-Provost, University of Pennsylvania, and for mail, Hotel Pennsylvania, 3900 Chestnut Street, Philadelphia, Pennsylvania.
- MERRICK, J. V.**, 253 South 16th Street, Philadelphia, Pennsylvania.
- MERRIMAN, THADDEUS**, Chief Engineer, Board of Water Supply, Municipal Building, New York City, New York.
- MERRITT, JAMES SMITH**, Mechanical Engineer, Abington, Pennsylvania.
- MERSHON, R. D.**, Consulting Engineer, 80th Street and East End Avenue, New York City, New York.
- MERZ, CHARLES H.**, Consulting Engineering, 32 Victoria Street, London, S. W., England.
- MERZ, EUGENE**, Manufacturer, The Heller and Merz Company, 338 Wilson Avenue, Newark, New Jersey.
- METTEN, JOHN F.**, Chief Engineer, Wm. Cramp and Sons Ship and Engine Building Company, Richmond and Norris Streets, Philadelphia, Pennsylvania.
- METZ, HERMAN A.**, Manufacturer and Importer of Chemicals and Dyestuffs, 122 Hudson Street, New York City, New York.
- MICHELSON, A. A.**, Professor of Physics, University of Chicago, Chicago, Illinois.
- MIDDLETON, ALBERT C.**, Director, 149 East Main Street, Moorestown, New Jersey.
- MILES, J. WALTER**, Electrical Engineer, Irwin, Pennsylvania.
- MILLER, CASPER W.**, Physician, Wallingford, Pennsylvania.
- MILLER, FRED J.**, Factory Manager, New Hope, Pennsylvania.
- MILLER, Dr. JOHN M.**, 4700 Wissahickon Avenue, Philadelphia, Pennsylvania.
- MILLER, SIMON**, Textile Manufacturer, 1530 Locust Street, 5-B, Philadelphia, Pennsylvania.
- MILLER, W. LASH**, Professor of Physical Chemistry, 8 Hawthorne Avenue, Toronto, 5, Canada.
- MILLIKEN, J.**, President, Pittsburgh Testing Laboratories, P. O. Box 1115, Pittsburgh, Pennsylvania.
- MILLS, GEO. M.**, President, Thomas Mills and Brothers, Incorporated, 1301 North 8th Street, Philadelphia, Pennsylvania.
- MILNE, DAVID**, Manufacturer, School House Lane, Germantown, Philadelphia, Pennsylvania.
- MILNE, FRANCIS F., Jr.**, 1714 Spruce Street, Philadelphia, Pennsylvania.
- MILNER, B. B.**, Engineer of Motive Power, Room 1237, Knickerbocker Building, Times Square, New York City, New York.
- MINER, Dr. HARLAN S.**, Chief Chemist, Welsbach Company, Gloucester, New Jersey.
- MISSIMER, GEORGE, Jr.**, Farmer, West Port Royal Avenue, Roxborough, Philadelphia, Pennsylvania.
- MITCHELL, HENRY F.**, Glazed Kid Manufacturer, 36th and Reed Streets, Philadelphia, Pennsylvania.
- MITCHELL, Dr. WALTER M.**, Metallurgical Engineer, Chemical Department, E. I. du Pont de Nemours and Company, Wilmington, Delaware, and for mail, 112 North 34th Street, Philadelphia, Pennsylvania.

- MITCHESON, JOSEPH MacGREGOR**, Assistant City Solicitor, 1018 Stock Exchange Building, Philadelphia, Pennsylvania.
- MITTEN, T. E.**, Chairman of Executive Committee, Philadelphia Rapid Transit Company, 1520 Spruce Street, Philadelphia, Pennsylvania.
- MIXER, CHARLES A.**, Engineer, Rumford Falls Power Company, Rumford, Maine.
- MODJESKI, RALPH**, Consulting Civil Engineer, 818 Widener Building, Philadelphia, Pennsylvania.
- MONROE, WILLIAM STANTON**, President, Sargent and Lundy, Inc., 1412 Edison Building, Chicago, Illinois.
- MOODY, LEWIS FERRY**, Consulting Engineer, William Cramp and Sons Ship and Engine Building Company, Richmond and Norris Streets, Philadelphia, Pennsylvania.
- MOORE, COLEMAN B.**, Haverford, Pennsylvania.
- MOORE, DAVID PELTON**, Patent Attorney, Warder Building, Washington, D. C.
- MOORE, HORACE E.**, Superintendent, Chester Heights, Delaware County, Pennsylvania.
- MOORE, W. E.**, President, W. E. Moore and Company, Engineers, Room 706, Union Bank Building, Pittsburgh, Pennsylvania.
- MOOREHOUSE, J. W.**, Electrical Supervisor, Reading Company, Reading, Pennsylvania.
- MORAN, DANIEL E.**, 9 East 45th Street, New York City, New York.
- MORAN, ROBERT** (Retired), Rosario, San Juan County, Washington.
- MORGAN, MARSHALL S.**, Fidelity Trust Company, 325 Chestnut Street, Philadelphia, Pennsylvania.
- MORRIS, A. SAUNDERS**, Mechanical Engineer, Haverford, Pennsylvania.
- MORRIS, EFFINGHAM B.**, Girard Trust Company, Philadelphia, Pennsylvania.
- MORRISSEY, JOHN P.**, Professor of Chemistry, 651 East Jefferson Avenue, Detroit, Michigan.
- MOYER, J. A.**, Director, Massachusetts Board of Education, State House, Boston, Massachusetts.
- MULL, J. HARRY**, President and General Manager, The William Cramp and Sons Ship and Engine Building Company, Richmond and Norris Streets, Philadelphia, Pennsylvania.
- MULLER, EDWARD ALBERT**, Vice-President and Secretary, The King Machine Tool Company, Winton Place, Cincinnati, Ohio.
- MULLER, RALPH H.**, Chemical Engineer, Apartment 50, 540 West 124th Street, New York City, New York.
- MULLIGAN, J. R.**, Engineering Department, The Bell Telephone Company, 261 North Broad Street, Philadelphia, Pennsylvania.
- MURDOCK, JOSEPH B.**, Rear-Admiral, U. S. N. (Retired), Danbury, New Hampshire.
- MURPHY, F. M.**, 1328 West 37th Street Drive, Los Angeles, California.
- MURPHY, PETER H.**, Address unknown.
- MURRAY, B. L.**, Chemist, Merck and Company, Rahway, New Jersey.
- MURRAY, HENRY H.**, Mechanical Engineer, Victor Talking Machine Company, Camden, New Jersey, and for mail, 204 Lippincott Avenue, Riverton, New Jersey.
- MURRAY, J. F.**, Assistant to Chief Engineer, Pennsylvania Railroad Company, 607 Broad Street Station, Philadelphia, Pennsylvania.
- MURRAY, THOMAS E.**, Consulting Electrical Engineer, 124 East 15th Street, New York City, New York.
- MURRAY, WILLIAM S.**, Consulting Engineer, Room 5601, Grand Central Terminal, New York City, New York.
- MYERS, ALLEN I.**, 314 North Chester Road, Swarthmore, Pennsylvania.
- NEBLETT, CARROL BERNARD**, Department of Photography, Texas A. and M. College, College Station, Texas.
- NEILER, SAMUEL G.**, Consulting Mechanical and Electrical Engineer, 1409 Manhattan Building, Chicago, Illinois.
- NETHERY, JOHN E.** (Retired), Address unknown.
- NEWBOLD, CLEMENT BUCKLEY, Jr.**, Student, Princeton University, Princeton, New Jersey, and for mail, Crosswicks House, Jenkintown, Pennsylvania.
- NICE, EUGENE E.**, Manufacturer, 272 South 2nd Street, Philadelphia, Pennsylvania.
- NICHOLS, CARROLL B.**, 1214 Widener Building, Philadelphia, Pennsylvania.
- NICHOLS, EDGAR BYRON**, 524 Wellington Avenue, Rochester, New York.
- NICHOLS, LEON W.**, Chemist, Glenolden, Pennsylvania.
- NICHOLS, Dr. WILLIAM H.**, Consulting Chemist, Chairman of Board of Directors, The Allied Chemical and Dye Corporation, 61 Broadway, New York City, New York.
- NIELSON, DAVID**, 350 Johnson Street, Bristol, Pennsylvania.
- NIGHTINGALE, DONALD ARCHER**, Chemist, Ambler, Pennsylvania.
- NORDEHAUS, CHARLES H.**, Radio Experimenter, 4313 North Springfield Avenue, Chicago, Illinois.
- NORMAN, BRADFORD**, Farmer, Newport, Rhode Island.
- NORMAN, REGINALD**, Farmer, Newport, Rhode Island.
- NORRIS, GEORGE L.**, Tool Specialist, 222 West 2nd Street, Wilmington, Delaware.
- NORTH, R. H.**, North Brothers Manufacturing Company, Lehigh Avenue and American Street, Philadelphia, Pennsylvania.
- NORTHROP, EDWIN FITCH**, Research Physicist, Palmer Physical Laboratory, Princeton, New Jersey.
- NOYES, STEPHEN H.**, Civil Engineer, Bureau of Surveys, City Hall, Philadelphia, Pennsylvania.
- NUTTING, P. G.**, Director of Research, 1644 Irving Street, Washington, D. C.
- OKLEAF, JAMES FRANCIS**, Chief of Research Laboratories, Vacuum Oil Company, Paulsboro, New Jersey.
- OATLEY, H. B.**, Chief Engineer, Locomotive Superheater Company, 145 Wilson Avenue, Flushing, New York.
- OBERLE, Dr. ALFRED**, Research Chemist, 700 Baltimore Avenue, Kansas City, Missouri.

- OBERLY, ALBERT D., Civil Engineer, Scottsdale, Pennsylvania.
- OERLEIN, KARL F., 2943 Cambridge Street, Philadelphia, Pennsylvania.
- OETTING, O. W. A., Electrical Engineer, Willard Battery Company, Cleveland, Ohio.
- OHMER, WILL I., President, Recording and Computing Machines Company, Dayton, Ohio.
- OLSEN, THORSTEN Y., Vice-President and Treasurer, Tinius Olsen Testing Machine Company, 500 North 12th Street, Philadelphia, Pennsylvania.
- OLSEN, TINIUS, Mechanical Engineer, 500 North 12th Street, Philadelphia, Pennsylvania.
- ORROK, GEORGE A., Consulting Engineer, 124 East 15th Street, New York City, New York.
- ORTENBLAD, RODOLPHO, Electrical Engineer, Rua de Baependy, 62, Rio de Janeiro, Brazil.
- OSBORNE, L. A., Vice-President, Westinghouse Electric and Manufacturing Company, 165 Broadway, New York City, New York.
- OTIS, SPENCER, Manufacturer, Railway Exchange Building, Chicago, Illinois.
- OUTERBRIDGE, ALEXANDER E., Jr., Metallurgist, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- OWEN, BARTRAM ASHMEAD, Civil Engineer, 411 Pine Street, Philadelphia, Pennsylvania.
- PALMER, Dr. FREDERIC, Jr., Professor of Physics, Haverford College, Haverford, Pennsylvania.
- PALMER, T. CHALKLEY, Second Vice-President, American Dyewood Company, and for mail, Chester, Pennsylvania.
- PALMER, WALTER, Engineer, American Dyewood Company, and for mail, 105 West 23rd Street, Chester, Pennsylvania.
- PARISH, LE GRAND, President, American Arch Company, Inc., 17 East 42nd Street, New York City, New York.
- PARKER, EDWARD W., Statistician and Economist, 437 Chestnut Street, Philadelphia, Pennsylvania.
- PARKER, JOHN C., in care of Lefax, Inc., Sheridan Building, Philadelphia, Pennsylvania.
- PARR, S. W., Professor of Applied Chemistry, 107 Chemistry Building, Urbana, Illinois.
- PARRISH, THADDEUS ROWLAND, Standardization Engineer, U. S. Gypsum Company, Chicago, Illinois, and for mail, 236 South Oak Park Avenue, Oak Park, Illinois.
- PARSONS, Sir CHARLES A., K.C.B., 6 Windsor Terrace, Newcastle-on-Tyne, England.
- PARSONS, Dr. LOUIS ALEXANDER, Professor of Physics, Swarthmore College, Swarthmore, Pennsylvania, and for mail, 4 Whittier Place, Swarthmore, Pennsylvania.
- PATTERSON, EDWARD B., Technical Editor, 42 West Walnut Lane, Merchantville, New Jersey.
- PATTERSON, FRANCIS D., Physician, Chief of Division of Industrial Hygiene and Engineering, Department of Labor and Industry, Harrisburg, and for mail, 3500 Grays Ferry Road, Philadelphia, Pennsylvania.
- PATTERSON, J. EDWARD, Vice-President, Arthur H. Thomas Company, 230 South 7th Street, Philadelphia, Pennsylvania.
- PAUL, H. N., Attorney-at-Law, 1815 Land Title Building, Philadelphia, Pennsylvania.
- PAUL, LAWRENCE T., Consulting Engineer, 105 Liberty Building, Broad and Chestnut Streets, Philadelphia, Pennsylvania.
- PEACOCK, SELINA EMMA, Organist, 1422 Master Street, Philadelphia, Pennsylvania.
- PEARSON, FREDERICK J., 25 East Washington Street, Chicago, Illinois.
- PEARSON, JOSHUA A., Purchasing Agent, The United Gas Improvement Company, 1401 Arch Street, Philadelphia, Pennsylvania.
- PEASE, F. N., Chief Chemist, Pennsylvania Railroad Company, P. O. Box 503, Altoona, Pennsylvania.
- PEASE, FRANCIS G., Astronomical Engineer, Mount Wilson Solar Observatory, Pasadena, California.
- PECK, G. L., Vice-President, Personnel Department, Pennsylvania System, Broad Street Station, Philadelphia, Pennsylvania.
- PEEK, FRANK WILLIAM, Jr., Consulting and Research Electrical Engineer, General Electric Company, Pittsfield, Massachusetts.
- PEMBERTON, Dr. RALPH, Physician, 2120 Sansom Street, and for mail, 2122 Sansom Street, Philadelphia, Pennsylvania.
- PENDER, HAROLD, Professor of Electrical Engineering, Dean, Moore School of Electrical Engineering, University of Pennsylvania, Philadelphia, Pennsylvania.
- PENNOCK, GEORGE L., 165 West Essex Avenue, Lansdowne, Pennsylvania.
- PENROSE, CHARLES, Electrical Engineer, in care of Day and Zimmermann, 1600 Walnut Street, Philadelphia, Pennsylvania.
- PENROSE, R. A. F., Jr., Geologist, 460 Bullitt Building, Philadelphia, Pennsylvania.
- PEPPER, DAVID, Engineer, Commonwealth Building, Philadelphia, Pennsylvania.
- PERKINS, GEORGE WESLEY, Instructor in Chemistry, Union Avenue, Delanco, New Jersey.
- PEROT, T. MORRIS, Jr., Malt Manufacturer, 605 Chestnut Street, Philadelphia, Pennsylvania.
- PERROT, EMILE G., Architect and Engineer, Boyertown Building, 1211 Arch Street, Philadelphia, Pennsylvania.
- PERRY, ROBERT S., President, Franklin H. Kalbfleisch Company, 31 Union Square, West, New York City, New York.
- PERSHING, General JOHN J., War Department, Washington, D. C.
- PETERSON, WALTER, 80 Federal Street, Boston, Massachusetts.
- PEW, J. HOWARD, President, Sun Oil Company, and Sun Shipbuilding Company, Finance Building, Philadelphia, Pennsylvania.
- PHILIPS, EDWIN S., President, Philbrin Corporation, Kennett Square, Pennsylvania.
- PICOLET, LUCIEN E., Mechanical Engineer, 116 North 34th Street, Philadelphia, Pennsylvania.

- PIERCE, G. A.**, Electrical Engineer, Wm. Cramp and Sons Ship and Engine Building Company, Philadelphia, Pennsylvania.
- PITMAN, Brigadier-General JOHN** (Retired), 611 Berkeley Avenue, Orange, New Jersey.
- PLACE, SAMUEL**, 622 Stanbridge Street, Norristown, Pennsylvania.
- PLACK, W. L.**, Architect and Structural Engineer, Southwest Corner 12th and Locust Streets, Philadelphia, Pennsylvania.
- PLATT, H. H.**, Mechanical Engineer, Wallingford, Pennsylvania.
- POND, Dr. SAMUEL ERNEST**, Assistant Professor of Physiology, School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania.
- POPE, FREDERICK**, Consulting Engineer, 60 Broadway, New York City, New York.
- POPE, RALPH W.**, Honorary Secretary, American Institute of Electrical Engineers, 570 Cherry Street, Elizabeth, New Jersey.
- PORTER, HARRY F.**, Ajax Electrothermic Corporation, Trenton, New Jersey.
- PORTER, Dr. HORACE C.**, Consulting Chemist and Chemical Engineer, 1833 Chestnut Street, Philadelphia, Pennsylvania.
- PORTER, J. BENTON**, Electrical Engineer, 1527 Spruce Street, Philadelphia, Pennsylvania.
- PORTER, ROLAND G.**, Gas Engineer, Swarthmore, Pennsylvania.
- POSER, Dr. M.**, 16 Vick Park B, Rochester, New York.
- POSTLETHWAITE, C. E.**, General Sales Manager, Pressed Steel Car Company, 55 Broad Street, New York City, New York.
- POTTER, ROWLAND S.**, Technical Director and Vice-President, American Photo Products Company, Verona, New Jersey, and for mail, 25 Trinity Place, Montclair, New Jersey.
- POTTS, TOSHUA R. H.**, Attorney-at-Law, 929 Chestnut Street, Philadelphia, Pennsylvania.
- POTTS, WILLIAM M.**, Civil Engineer, Wyebrooke, Chester County, Pennsylvania.
- POWER, ARCHIE DAYTON**, Physicist, Department of Physics, Lawrence College, Appleton, Wisconsin.
- PRATT, CARL D.**, Chemist, 412 West Broad Street, Tamaqua, Pennsylvania.
- PRICE, MAX CHARLES**, Architect, Punta Gorda, Florida.
- PRICE, MORTON MOORE**, Sales Agent, The Babcock and Wilcox Company, 1120 Packard Building, Philadelphia, Pennsylvania.
- PURCELL, JOHN**, Assistant to Vice-President, Atchison, Topeka and Santa Fe Railway Company, 80 East Jackson Boulevard, Chicago, Illinois.
- QUIMBY, HENRY H.**, Consulting Structural Engineer, 4951 Pine Street, Philadelphia, Pennsylvania.
- QUINN, C. H.**, Electrical Engineer, Room 420, Pacific Mutual Building, 660 Market Street, San Francisco, California.
- RAFF, ALBERT RAYMOND**, Builder, 1631-1635 Thompson Street, Philadelphia, Pennsylvania, and for mail, 1300 Oak Lane Avenue, Philadelphia, Pennsylvania.
- RAMSBURG, C. J.**, Vice-President, The Koppers Company, Pittsburgh, Pennsylvania.
- RAMSEY, GEORGE W.**, Patent Attorney, Woolworth Building, New York City, New York.
- RANDALL, HENRY LeROY**, President, Riverside Metal Company, Riverside, New Jersey, and for mail, 709 Linden Street, Riverton, New Jersey.
- RANDOLPH, ALFRED J. MAGILL**, Electrical Engineer, Post Office Box 395, Warrenton, Virginia.
- RANGER, RICHARD H.**, Radio Engineer, 66 Broad Street, New York City, New York.
- RAPP, I. M.**, Physicist, R. D. 3, Phoenixville, Pennsylvania.
- RAU, ALBERT GEORGE**, Professor of Mathematics and Dean, Moravian College and Theological Seminary, Bethlehem, Pennsylvania.
- RAUTENSTRAUCH, WALTER**, Vice-President and General Manager, Liberty Yeast Corporation, 2 West 46th Street, New York City, New York.
- RAYMOND, WARD**, Mechanical Engineer, 908 Paxinosa Avenue, Easton, Pennsylvania.
- REA, SAMUEL**, Retired President, Pennsylvania Railroad Company, Room 215, Broad Street Station, Philadelphia, Pennsylvania.
- REATH, THEODORE W.**, Attorney-at-Law, 1201 Commercial Trust Building, Philadelphia, Pennsylvania.
- REBER, Colonel SAMUEL**, Director, Radio Corporation of America, 66 Broad Street, New York City, New York.
- REBMANN, G. R.**, Vice-President, Otis Elevator Company, 16th and Samson Streets, Philadelphia, Pennsylvania.
- REDFIELD, ROBERT S.**, Wayne, Pennsylvania.
- REEDER, HOWARD EMERSON**, Civil Engineer, 1204 Sansom Street, and for mail, 542 East Mayland Street, Philadelphia, Pennsylvania.
- REESE, CHARLES L.**, Chemical Engineer, E. I. du Pont de Nemours and Company, Wilmington, Delaware.
- REICHERDT, HENRY** (Retired), 3581 Queen Lane, East Falls, Philadelphia, Pennsylvania.
- REILLY, HERSCHELL EDWARD**, Professor of Physics, McGill University, Montreal, P. Q., Canada.
- REILLY, MARION**, 2015 DeLancey Place, Philadelphia, Pennsylvania.
- RENO, JESSE W.**, Consulting Engineer, 1158 Fifth Avenue, New York City, New York.
- REOCH, ALEXANDER ERNEST**, Electrical Engineer, The Radio Corporation of America, 233 Broadway, New York City, New York.
- RESINES, JAVIER**, Industrial Chemist, Racquet Club, Philadelphia, Pennsylvania.
- RHOADS, J. J.**, Superintendent, Pennsylvania Railroad Company, and for mail, Miller Park, Franklin, Pennsylvania.
- RICE, CHARLES D.**, Manager of Factory, Underwood Typewriter Company, 581 Capitol Avenue, Hartford, Connecticut.
- RICE, E. W., Jr.**, Electrical Engineer, President, General Electric Company, Schenectady, New York.
- RICHARDS, CHARLES RUSS**, President, Lehigh University, Bethlehem, Pennsylvania.

- RICHARDS, HORACE CLARK**, Professor of Mathematical Physics, University of Pennsylvania, and for mail, 4812 Fairmount Avenue, Philadelphia, Pennsylvania.
- RICHARDS, JOHN**, Address unknown.
- RICHARDS, THEODORE WM.**, Director, Wolcott Gibbs Memorial Laboratory, Harvard University, Cambridge, Massachusetts.
- RICHARDSON, CHARLES E.**, Engineer, in care of The Yale Club, 44th Street and Vanderbilt Avenue, New York City, New York.
- RICKETTS, L. D.**, Mining Engineer, 325 Pacific Southwest Bank Building, Pasadena, California.
- RIDGWAY, ELLIS B.**, Manufacturer, 367 West Main Street, Coatesville, Pennsylvania.
- RIDGWAY, ROBERT**, Chief Engineer, Board of Transportation, 49 Lafayette Street, New York City, New York.
- RIDGWAY, WILLIAM H.**, Civil Engineer and Manufacturer, The Craig Ridgway and Son Company, Coatesville, Pennsylvania.
- RIEHLE, FREDERICK A.**, President, Riehle Brothers Testing Machine Company, 1424 North 9th Street, Philadelphia, Pennsylvania.
- RIGLING, ALFRED**, Librarian, The Franklin Institute, and for mail, 4835 Haverford Avenue, Philadelphia, Pennsylvania.
- RINGWALT, ROLAND**, Clergyman, 3016 Carman Street, Camden, New Jersey.
- RITCHIE, KENNETH MONTGOMERY**, Chemist, Armstrong Cork Company, Gloucester, New Jersey.
- RITTER, LOUIS E.**, Consulting Civil Engineer, 1707 Marquette Building, Chicago, Illinois.
- RITTMAN, Dr. W. F.**, Chemical Engineer, Carnegie Institute of Technology, Pittsburgh, Pennsylvania.
- ROBB, RUSSELL**, Member of Firm, Stone and Webster Engineering Corporation, 147 Milk Street, Boston, Massachusetts.
- ROBERTS, CHARLES C.**, Chemist, Arthur H. Thomas Company, Philadelphia, and for mail 75 West La Crosse Avenue, Lansdowne, Pennsylvania.
- ROBINSON, ANTHONY W.**, Insurance, 6 College Avenue, Haverford, Pennsylvania.
- ROBINSON, DWIGHT P.**, Consulting Engineer, Stuyvesant Avenue, Milton Point, Rye, New York.
- ROBINSON, EDMUND G.**, Chemist, 909 Nottingham Road, Wilmington, Delaware.
- ROBINSON, WILLIAM WILSON**, Ship and Yacht Builder, Camden, New Jersey, and for mail, 6446 Sherwood Road, Overbrook, Pennsylvania.
- RODMAN, HUGH**, Engineer and Manufacturer, in care of Rodman Chemical Company, Verona, Pennsylvania.
- RODMAN, Dr. JESSIE A.**, Teacher of Physics, 81 High Street, Germantown, Philadelphia.
- ROESSLER, FRANZ**, Manufacturing Chemist, 89 High Street, Perth Amboy, New Jersey.
- ROGERS, FRANK D.**, 1702 West Erie Avenue, Philadelphia, Pennsylvania.
- ROGERS, FRANK H.**, Mechanical Engineer, William Cramp and Sons Ship and Engine Building Company, Philadelphia, Pennsylvania.
- ROGERS, JAMES S.**, Attorney-at-Law, 701 Commonwealth Trust Building, Philadelphia, Pennsylvania.
- ROGERS, TALBOT MERCER**, Student, 7 E. M. Witherspoon Hall, Princeton University, Princeton, New Jersey.
- ROLLE, SYLVAN D.**, Draftsman, The Bell Telephone Company of Pennsylvania, and for mail, 2143 North 19th Street, Philadelphia, Pennsylvania.
- ROLLER, FRANK W.**, Electrical and Mechanical Engineer, 233 Broadway, New York City, New York.
- RONDINELLA, L. F.**, Head of Drawing and Designing, West Philadelphia High School for Boys, 48th and Walnut Streets, Philadelphia, Pennsylvania.
- ROONEY, FREDERICK M.**, The Emil Greiner Company, 55 Fulton Street, New York City, New York.
- ROOSEVELT, NICHOLAS G.**, Vice-President, Day and Zimmermann, Inc., Engineers, 1600 Walnut Street, Philadelphia, Pennsylvania.
- ROSENBAUM, MORRIS**, Foreign Exchange, 605 South 3rd Street, Philadelphia, Pennsylvania.
- ROSENBAUM, W. A.**, Patent Attorney, 41 Park Row, New York City, New York.
- ROSENGARTEN, FREDERIC**, Manufacturing Chemist, P. O. Box 1625, Philadelphia, Pennsylvania.
- ROSENGARTEN, Dr. GEORGE D.**, Manufacturing Chemist, P. O. Box 1625, Philadelphia, Pennsylvania.
- ROSIN, JOSEPH**, Chemist, Powers-Weightman-Rosengarten Company, 9th and Parrish Streets, Philadelphia, Pennsylvania.
- ROSS, T. EDWARD**, Certified Public Accountant, 1209 Morris Building, Philadelphia, Pennsylvania.
- ROTHERMEL, JOHN JACOB**, Teacher of Physics, Eastern High School, 1126 Vermont Avenue, N. W., Washington, D. C.
- ROWLAND, CHARLES B.**, Vice-President, Continental Iron Works, West and Calyer Streets, Brooklyn, New York.
- ROWLAND, THEODORE S.**, Head of Science Department, Northeast High School, and for mail, 6311 North Camac Street, Philadelphia, Pennsylvania.
- RUGG, W. S.**, The University Club, Natalie Street, Pittsburgh, Pennsylvania.
- RUMBOUGH, JOHN B.**, Consulting Mechanical Engineer, R. F. D. No. 1, Ardan, North Carolina.
- RUSBY, J. M.**, Engineer of Tests, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- RUSSELL, CHARLES J.**, Manager, Sales Department, The Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- RUST, HENRY P.**, Civil Engineer, Manager of Harper and Taylor, Engineers, Bankers Trust Building, Philadelphia, Pennsylvania.

- RUTHERFORD, Sir ERNEST**, Cavendish Professor of Experimental Physics, The University of Cambridge, Cambridge, England.
- SABINE, PAUL E.**, Physicist, Riverbank Laboratories, Geneva, Illinois.
- SADTLER, SAMUEL S.**, Consulting Chemist, 210 South 13th Street, Philadelphia, Pennsylvania.
- SAEGMULLER, G. N.**, Vice-President, in care of Bausch and Lomb Optical Company, Rochester, New York.
- SAFFORD, Dr. FREDERICK HOLLISTER**, Professor of Mathematics, College Hall, University of Pennsylvania, Philadelphia, Pennsylvania.
- SAGEBEER, RICHARD G.**, Teaching Fellow, 9 Dunstable Road, Cambridge, Massachusetts.
- SALMON, FREDERICK W.**, Civil and Mechanical Engineer, P. O. Box 1392, Birmingham, Alabama.
- SALOM, PEDRO G.**, Electro-Chemical Engineer, Commonwealth Trust Building, Philadelphia, Pennsylvania.
- SAMUEL, J. BUNFORD**, Retired Iron Merchant, 1609 Spruce Street, Philadelphia, Pennsylvania.
- SANBORN, EDWARD H.**, Coal Mining, 1100 Commercial Trust Building, Philadelphia, Pennsylvania.
- SANDERSON, R. P. C.**, The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania, and for mail, Moylan, Pennsylvania.
- SANDS, BENJAMIN WILEY**, Research Worker, 342 Fifth Street, S. E., Washington, D. C.
- SANFORD, RUFUS H.**, Librarian, The Baldwin Locomotive Works, Philadelphia, Pennsylvania.
- SANVILLE, HENRY F.**, Engineer, 1015 Chestnut Street, Philadelphia, Pennsylvania.
- SARGENT, CHARLES E.**, Research Engineer, Box 371, Lakeland, Florida.
- SARGENT, HENRY B.**, Hardware Manufacturer, 247 Church Street, New Haven, Connecticut.
- SARTAIN, PAUL J.**, Physician, 2006 Walnut Street, Philadelphia, Pennsylvania.
- SATTERTHWAITE, GEORGE**, Manufacturer of Steel, in care of Henry Disston and Sons, Tacony, Philadelphia, Pennsylvania.
- SAUER, FRANK H.**, Draftsman, 1307 Atlantic Avenue, Camden, New Jersey.
- SAUNDERS, LEWIS E.**, Manager of Research Laboratory, Norton Company, and for mail, 262 Salisbury Street, Worcester, Massachusetts.
- SAUNDERS, WALTER M.**, Analytical and Consulting Chemist, 20 Dewey Street, Olneyville, Providence, Rhode Island.
- SAUNDERS, WILLIAM E.**, Librarian, U. G. I. Building, Broad and Arch Streets, Philadelphia, Pennsylvania.
- SAVAGE, HARLOW DOW**, Engineer, Scarsdale, New York.
- SAWTELLE, WILLIAM OTIS**, Professor of Physics, Haverford College, Haverford, Pennsylvania.
- SCANNELL, GERALD EDWARD**, Experimental Machinist, 3123 Tulip Street, Philadelphia, Pennsylvania.
- SCHAFER, W. C.**, Engineering Department, The Bell Telephone Company, 261 North Broad Street, Philadelphia, Pennsylvania.
- SCHEETZ, O. C.**, Engineering Department, The Bell Telephone Company, 261 North Broad Street, Philadelphia, Pennsylvania.
- SCHEHL, OSCAR L.**, Mechanical Engineer, 1631 Girard Avenue, Philadelphia, Pennsylvania.
- SCHLACKS, CHARLES H.**, President, Keystone Watch Case Company, Riverside, New Jersey, and for mail, Bryn Mawr, Pennsylvania.
- SCHLAFGE, WILLIAM S.**, General Mechanical Superintendent, Erie Railroad Company, 50 Church Street, New York City, New York.
- SCHROM, OSCAR G.**, Mechanical Engineer, 6017 Nassau Street, Philadelphia, Pennsylvania.
- SCHWANK, JAMES L.**, 5760 North Marshall Street, Philadelphia, Pennsylvania.
- SCOTT, WM. M.**, Draftsman, Box 76, Radnor, Pennsylvania.
- SCULL, CHESTER, Jr.**, 2745 North 23rd Street, Philadelphia, Pennsylvania.
- SEELY, LESLIE B.**, Teacher, 5918 Pulaski Avenue, Germantown, Philadelphia, Pennsylvania.
- SELGA, M.**, Meteorologist and Astronomer, Manila Observatory, Manila, Philippine Islands.
- SELLERS, ALEXANDER**, Manufacturer, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- SELLERS, COLEMAN, 3rd**, Mechanical Engineer, Wm. Sellers and Company, Inc., 1600 Hamilton Street, Philadelphia, Pennsylvania.
- SELLERS, HORACE W.**, Architect, Ardmore, Pennsylvania.
- SELLERS, HOWARD**, Millbourne House, Millbourne, Pennsylvania.
- SELLERS, RICHARD**, Bellevue, Delaware.
- SELLERS, RICHARD C.**, Civil Engineer, Swarthmore, Pennsylvania.
- SELLERS, Mrs. WILLIAM**, Bellevue, Delaware.
- SELLERS, WILLIAM F.**, Manufacturer of Water Tube Boilers, Edge Moor, Delaware.
- SENER, RALPH TOWNSEND**, Vice-President, Engineering, Mitten Management, Inc., 1520 Spruce Street, Philadelphia, Pennsylvania.
- SEVERY, MELVIN L.**, Inventor and Author, 431 South Berendo Street, Los Angeles, California.
- SHACKELFORD, BENJAMIN E.**, Physicist, Westinghouse Lamp Company, Bloomfield, New Jersey.
- SHAND, A. C.**, Civil Engineer, Merion, Pennsylvania.
- SHARP, Dr. CLAYTON H.**, Technical Director, Electrical Testing Laboratories, 80th Street and East End Avenue, New York City, New York.
- SHARP, Dr. HENRY M.**, Physicist, Radiological Laboratory, Philadelphia General Hospital, Philadelphia, Pennsylvania, and for mail, 5232 Chester Avenue, Philadelphia, Pennsylvania.
- SHATTUCK, A. F.**, Chief Chemist, Solvay Process Company, and for mail, 614 Canon Drive, Beverly Hills, California.
- SHATTUCK, JOHN D.**, Gas Engineer, Chester, Pennsylvania.
- SHAW, A. NORMAN**, Associate Professor of Physics, McGill University, Montreal, Canada.

- SHAW, DEXTER NICHOLS**, Chemical Engineer, 32 South Broad Street, Philadelphia, Pennsylvania.
- SHERRON, J. F., Jr.**, Assistant Supervisor, Reading Company, 9th and Green Streets, Philadelphia, Pennsylvania.
- SHIMER, PORTER W.**, Chemist and Metallurgist, Easton, Pennsylvania.
- SHMIDHEISER, W. A.**, Mechanical Engineer, The Bell Telephone Company of Pennsylvania, and for mail, 6017 Pine Street, Philadelphia, Pennsylvania.
- SHOBER, SAMUEL L.**, Special Representative, Union Switch and Signal Company, and for mail, Rittenhouse Club, 1811 Walnut Street, Philadelphia, Pennsylvania.
- SHOEMAKER, SAMUEL**, Builder and Real Estate, 1214-1215 Franklin Trust Building, 1500 Chestnut Street, Philadelphia, Pennsylvania.
- SHOEMAKER, THOMAS H.** (Retired), 120 West Tulpehocken Street, Germantown, Philadelphia, Pennsylvania.
- SHRADER, J. E.**, Professor of Physics, Drexel Institute, Philadelphia, Pennsylvania.
- SHUMWAY, EDWARD**, Merion, Pennsylvania.
- SIEG, Dr. LEE PAUL**, Professor of Physics, University of Pittsburgh, Pittsburgh, Pennsylvania.
- SILLCOX, LEWIS K.**, Mechanical and Electrical Engineer, Herrick Road, Box 579, Riverside, Illinois.
- SILVA, A. D.**, 6734 Ogontz Avenue, Philadelphia, Pennsylvania.
- SIMS, Rear-Admiral WILLIAM S.**, U. S. N., 77 Rhode Island Avenue, Newport, Rhode Island.
- SIMSOHN, JULIAN STERN**, Chemist, Southeast corner Broad Street and Girard Avenue, Philadelphia, Pennsylvania.
- SINKLER, JOHN P. B.**, Architect, 412 Otis Building, 112 South 16th Street, Philadelphia, Pennsylvania.
- SKINNER, C. E.**, Engineer, Research Division, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania.
- SKINNER, H. J.**, President, Skinner, Sherman and Esselen, Inc., Industrial Chemists, 276 Stuart Street, Boston, Massachusetts, and for mail, 71 West Chestnut Street, Wakefield, Massachusetts.
- SKINNER, ORVILLE CAMPBELL**, Metallurgical Engineer, Superintendent, Standard Steel Works, Burnham, Pennsylvania.
- SLOATMAN, W. S.**, Supervisor, The Reading Company, Tuckahoe, New Jersey.
- SMALLING, ELMER, Jr.**, Student, 2939 North Camac Street, Philadelphia, Pennsylvania.
- SMITH, A. DW.**, Mining Engineer, 1732 Commercial Trust Building, Philadelphia, Pennsylvania.
- SMITH, ALBERT W.**, Professor of Industrial Chemistry, Case School of Applied Science, and for mail, 11333 Bellflower Road, Cleveland, Ohio.
- SMITH, A. T.**, in care of The Permutit Company, 440 Fourth Avenue, New York City, New York.
- SMITH, AUGUSTUS**, Civil Engineer, Elizabeth, R. F. D. No. 2, New Jersey.
- SMITH, EDWARD W.**, Chemical Engineer, 535 Church Lane, Germantown, Philadelphia, Pennsylvania.
- SMITH, ELMER A.**, Consulting Electrical Engineer, 596 Columbia Avenue, and for mail, 1281 Pat. Pl'k. Road, Secaucus, New Jersey.
- SMITH, FRANK W.**, Vice-President and General Manager, The United Electric Light and Power Company, 130 East 15th Street, New York City, New York.
- SMITH, HASELTINE**, Insurance Broker, 326 Walnut Street, Philadelphia, Pennsylvania.
- SMITH, HERBERT S. S.**, Professor of Civil Engineering, 205 Wallace Street, Stroudsburg, Pennsylvania.
- SMITH, IOWA**, Commercial Engineer, International Telephone Company, Clinton Building, Columbus, Ohio.
- SMITH, IRVING B.**, Chief of Research Department, Leeds and Northrup Company, and for mail, Ambler, Pennsylvania.
- SMITH, J. WALDO**, Consulting Engineer, Board of Water Supply, City of New York, Municipal Building, New York City, New York.
- SMITH, OBERLIN**, Mechanical Engineer and Manufacturer, in care of Ferracute Machine Company, Bridgeton, New Jersey.
- SMITH, P. F., Jr.**, Paoli, Chester County, Pennsylvania.
- SMITH, S. D.**, Machinist, 1616 North Redfield Street, Philadelphia, Pennsylvania.
- SMITH, WALTER B.**, Builder, 6490 Woodbine Avenue, Overbrook, Philadelphia, Pennsylvania.
- SMITH, WILBUR ANDERSON**, Student, 808 Station Avenue, Haddon Heights, New Jersey.
- SMITH, W. HINCKLE**, Banker, Bryn Mawr, Pennsylvania.
- SMITH, W. LEIGH**, Chemist, The Viscose Company, Box 171, Marcus Hook, Pennsylvania.
- SNARE, FREDERICK**, Contracting Engineer, 114 Liberty Street, New York City, New York.
- SNELLING, WALTER O.**, Research Chemist, 110 South 13th Street, Allentown, Pennsylvania.
- SNOOK, H. CLYDE**, Electrical Engineer, care of Western Electric Company, 463 West Street, New York City, New York.
- SNYDER, CLINTON F.**, Chemist, Minersville, Pennsylvania.
- SNYDER, Professor MONROE B.**, Teacher and Astronomer, 111 Grand View Road, Ardmore, Pennsylvania.
- SONODA, S.**, Knida 15, Inari, near Kyoto, Japan.
- SOUTHALL, JAMES P. C.**, Professor of Physics, Columbia University, New York City, New York.
- SPACKMAN, Lieutenant-Colonel H. S.**, Egypt Mills Post Office, Pike County, Pennsylvania.
- SPENCER, H. B.**, 2012 Massachusetts Avenue, N. W., Washington, D. C.
- SPENCER, PAUL**, Electrical Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.

- SPENCER, THOMAS**, Engineer, 3523 Balsam Avenue, Indianapolis, Indiana.
- SPERR, F. W., Jr.**, Chief Chemist, The H. Koppers Company, Mellon Institute, Pittsburgh, Pennsylvania.
- SPERRY, ELMER A.**, Engineer, The Sperry Gyroscope Company, Sperry Building, Manhattan Bridge Plaza, Brooklyn, New York.
- SPICER, H. N.**, Metallurgical Engineer, The Architects Building, 247 Park Avenue, New York City, New York.
- SPITZ, SAMUEL**, Inventor, 2100 South Bronson Street, Los Angeles, California.
- SPITZGLASS, J. M.**, Mechanical Engineer, 2240 Diversey Boulevard, Chicago, Illinois.
- SPRAGUE, FRANK J.**, Consulting Engineer, President, Sprague Safety Control and Signal Corporation, 421 Canal Street, New York City, New York.
- SPRONG, S. D.**, Electrical Engineer, Room 309, 25 Church Street, New York City, New York.
- SPROUL, Hon. WM. C.**, Manufacturer, 117 South Sixteenth Street, Philadelphia, Pennsylvania.
- SPRUANCE, W. C.**, Vice-President, E. I. du Pont de Nemours and Company, Room 9056, Wilmington, Delaware.
- SQUIER, Major-General GEORGE OWEN, K. C. M. G., D. S. C.**, War Department, Washington, D. C.
- ST. JOHN, ANCEL**, Consulting Physicist, Room 404, 505 Fifth Avenue, New York City, and for mail, 17 Hix Avenue, Rye, New York.
- STANFORD, Captain H. R.**, Civil Engineer (C. E. C.), U. S. N., Bureau of Yards and Docks, Navy Department, Washington, D. C.
- STEEL, JOSEPH M.**, Building Constructor, 1600 Arch Street, Philadelphia, Pennsylvania.
- STEINER, OSCAR**, Mechanician, Bartol Research Foundation of The Franklin Institute, 127 North 19th Street, Philadelphia, Pennsylvania, and for mail, 131 North 19th Street, Philadelphia, Pennsylvania.
- STEINMETZ, JOSEPH ALLISON**, Designer, Janney, Steinmetz and Company, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- STEBER, HENRY J.**, Chemist, 115 Beverly Road, Montclair, New Jersey.
- STEVENS, JOHN S.**, 9th Street and Montgomery Avenue, Philadelphia, Pennsylvania.
- STEVENS, ROYAL B.**, Lehigh Telephone Company, Markle Bank Building, Hazleton, Pennsylvania.
- STEVENSON, Dr. A. R., Jr.**, Electrical Engineer, General Electric Company, 6 Union Street, Schenectady, New York.
- STEVENSON, S. PRICE**, Manufacturer of Cold Storage Doors, 1500 West 4th Street, Chester, Pennsylvania.
- STEWART, A. V.**, Plant Department, The Bell Telephone Company, 1230 Arch Street, Philadelphia, Pennsylvania.
- STEWART, FRANK H.**, Dealer in Electrical Supplies, Old Mint Building, Philadelphia, Pennsylvania.
- STEWART, FRANK H.**, 4416 North 15th Street, Philadelphia, Pennsylvania.
- STEWART, RALPH C.**, Attorney-at-Law, Sydenham Building, 1512 Walnut Street, Philadelphia, Pennsylvania.
- STEWART, THOMAS S.**, Physician, 1532 Pine Street, Philadelphia, Pennsylvania.
- STILLWELL, L. B.**, Consulting Engineer, 90 West Street, New York City, New York.
- STINE, WILBUR M.**, Author, 3932 Haverford Avenue, Philadelphia, Pennsylvania.
- STOERTZ, HOWARD**, Research Chemist, Electric Storage Battery Company, and for mail, 430 West Durham Street, Mount Airy, Philadelphia, Pennsylvania.
- STOKES, FRANCIS J.**, Olney, Philadelphia, Pennsylvania.
- STOKLEY, JAMES**, Student, in care of Science Service, B and 21st Streets, N. W., Washington, D. C.
- STONE, C. W.**, Electrical Engineer, General Electric Company, Schenectady, New York.
- STONE, JOHN STONE**, Consulting Electrical Engineer, 3942 Alameda Street, San Diego, California.
- STOTESBURY, E. T.**, Banker, Chestnut and 5th Streets, Philadelphia, Pennsylvania.
- STOUGHTON, A. E.**, Attorney-at-Law, 1506 Land Title Building, Philadelphia, Pennsylvania.
- STOUT, ORIN C.**, Industrial Engineer, P. O. Box 865, Columbus, Ohio.
- STRADLING, Dr. G. F.**, Teacher, Principal, Northeast High School, and for mail, 5120 Newhall Street, Germantown, Philadelphia, Pennsylvania.
- STRONG, WILLIAM WALKER**, Consulting Physicist, 500 South York Street, Mechanicsburg, Cumberland County, Pennsylvania.
- STROUD, EDWARD A.**, Florist, 508 South 41st Street, Philadelphia, Pennsylvania.
- STUTZ, ERNEST**, Representative for Foreign Patents, 1705 Hope Street, South Pasadena, California.
- STYRI, Dr. HAAKON**, Chief Chemist, S. H. F. Research Laboratory, Front Street and Erie Avenue, Philadelphia, Pennsylvania.
- SULZNER, CHARLES F.** (Retired), 1006 Henrietta Towers, Miami, Florida.
- SUPPLEE, WM. H.**, Factory Manager, The S. S. White Dental Manufacturing Company, Unity and Oakland Streets, Frankford, Philadelphia, Pennsylvania.
- SUTTON, FRANK W.**, Industrial Engineer, Box 26, San Diego, California.
- SUYDAM, V. A.**, Professor of Physics and Head of the Physics Department, Beloit College, and for mail, 1224 Porter Avenue, Beloit, Wisconsin.
- SWAAB, SOLOMON M.**, Civil Engineer, 210 City Hall, Philadelphia, Pennsylvania, and for mail, 1629 Diamond Street, Philadelphia, Pennsylvania.
- SWANN, WILLIAM FRANCIS GRAY**, Professor of Physics, Sloane Laboratory, Yale University, New Haven, Connecticut.
- SWENSON, MAGNUS**, President and Treasurer, Southern Wisconsin Power Company, Madison, Wisconsin.
- SYKES, JOHN P.**, The Baldwin Locomotive Works, Broad and Spring Garden Streets, Philadelphia, Pennsylvania.

- SYNNESTVEDT, ARTHUR, Student, Bryn Athyn, Pennsylvania.
- TABER, GEORGE H., Vice-President, Gulf Refining Company, P. O. Box 1214, Pittsburgh, Pennsylvania.
- TAGGART, WALTER T., Professor of Chemistry, University of Pennsylvania, Philadelphia, Pennsylvania.
- TAIT, EDWARD H., Virginville, Pennsylvania.
- TAIT, F. M., Callahan Bank Building, Dayton, Ohio.
- TALBOT, H. P., Professor of Inorganic Chemistry, Massachusetts Institute of Technology, Cambridge, Massachusetts.
- TANBERG, DR. ARTHUR P., Chemist, E. I. du Pont de Nemours and Company, Henry Clay, Delaware.
- TATE, ALFRED O., President, Tate Electrolytic Textile Processes, Incorporated, 45 Sceptre House, 169-173 Regent Street, London, W. I, England.
- TATNALL, J. S., Traffic Department, The Bell Telephone Company, 261 North Broad Street, Philadelphia, Pennsylvania.
- TATNALL, DR. ROBERT R., Research Engineer, J. E. Rhoads and Sons, Wilmington, Delaware.
- TAWS, LOUIS, Address unknown.
- TAYLOR, DAVID WATSON, Rear-Admiral, U. S. N., 1813 19th Street, N. W., Washington, D. C.
- TAYLOR, H. BIRCHARD, President, Harper and Taylor, Inc., Bankers Trust Building, Philadelphia, Pennsylvania.
- TAYLOR, HOLLINSHEAD N., Tinplate Manufacturer, 300 Chestnut Street, Philadelphia, Pennsylvania.
- TAYLOR, LOWNDES, Box 3, Route 1, West Chester, Pennsylvania.
- TEEPLE, DR. JOHN E., Consulting Chemist and Chemical Engineer, 50 East 41st Street, New York City, New York.
- TEMPLE, EDWARD B., Swarthmore, Pennsylvania.
- THOMAS, ARTHUR H., Laboratory Appliances, West Washington Square, Philadelphia, Pennsylvania.
- THOMAS, C. C., Professor of Mechanical Engineering, 310-311 Union Oil Building, 617 West Seventh Street, Los Angeles, California.
- THOMAS, L. E., President, Reading Iron Company, Reading, Pennsylvania.
- THOMPSON, ARTHUR W., President, Philadelphia Company, 435 Sixth Avenue, Pittsburgh, Pennsylvania.
- THOMPSON, HUGH L., Consulting Engineer, Waterbury, Connecticut.
- THOMPSON, PAUL, Northwest corner Broad and Arch Streets, Philadelphia, Pennsylvania.
- THOMSON, PROFESSOR ELIHU, Electrical Engineer, 22 Monument Avenue, Swampscott, Massachusetts.
- THOMSON, FRANCIS DUPONT, Engineer, 241 East Main Street, Elkton, Maryland.
- THOMSON, SIR JOSEPH J., Trinity College, Cambridge, England.
- THUROW, WILLIAM HERMAN, Electrical Engineer, 30 Müllerstr, Berlin N. 65, Germany.
- THWING, DR. CHAS. BURTON, 3339 Lancaster Avenue, Philadelphia, Pennsylvania.
- TIDDY, WILLIAM, Chief Chemist, Rainey-Wood Coke Company, Swedeland, Pennsylvania.
- TIEMANN, HUGH P., Metallurgical Engineer, Carnegie Steel Company, Pittsburgh, Pennsylvania.
- TIKHONOVITCH, BENEDICT, Electrical Engineer, The New York Edison Company, 130 East 15th Street, and for mail, 201 West 109th Street, New York City, New York.
- TILGHMAN, B. C., "The Hermitage" near Centreville, Queen Ann County, Maryland.
- TILY, HERBERT JAMES, Merchant, Strawbridge and Clothier, Market and Eighth Streets, Philadelphia, Pennsylvania.
- TOCH, DR. MAXIMILIAN, Paint Manufacturer, Director, Research Laboratories, Toch Brothers, 110 East 42nd Street, New York City, New York.
- TORCHIO, PHILIP, Electrical Engineer, Vice-President, The New York Edison Company, 124 East 15th Street, New York City, New York.
- TOULMIN, H. A., Jr., Patent Attorney, 901 Schwind Building, Dayton, Ohio.
- TOWLE, HERBERT L., Technical Advertising, 4553 Adams Avenue, Frankford, Philadelphia, Pennsylvania.
- TOWNEND, R. V., Research Chemist, Department of Chemistry, University of Delaware, Newark, Delaware.
- TOWNSEND, JOHN SEALY, Professor of Physics, New College, Oxford, England.
- TOWNSEND, J. W., 825 Montgomery Avenue, Bryn Mawr, Pennsylvania.
- TRAUTWINE, JOHN C., 3rd, Civil Engineer, 331 West Front Street, Media, Pennsylvania.
- TRENCH, W. W., The General Electric Company, Schenectady, New York.
- TREXLER, Colonel HARRY C., President, Lehigh Portland Cement Company, Allentown, Pennsylvania.
- TROWBRIDGE, PROFESSOR AUGUSTUS, Teacher, Princeton University, Princeton, New Jersey.
- TRUE, RODNEY H., Professor of Botany, University of Pennsylvania, Philadelphia, Pennsylvania.
- TRUEMAN, WILLIAM H., Dentist, 47 High Street, Germantown, Philadelphia, Pennsylvania.
- TULL, CHARLES EDGAR, Electrical Contractor, 1832 Ludlow Street, Philadelphia, Pennsylvania.
- TURNER, O. A., Address unknown.
- TUTTLE, E. B., Engineer of Transmission and Protection, The Bell Telephone Company of Pennsylvania, 261 North Broad Street, Philadelphia, Pennsylvania.
- TUTTLE, WM. C., Manager of Trust Investments, Girard Trust Company, Philadelphia, Pennsylvania.
- TUTWILER, C. C., Consulting Gas Chemist, West Conshohocken, Pennsylvania.
- TYLER, SYDNEY F., Land Title Building, Philadelphia, Pennsylvania.
- TYSON, H. P., Collegeville, Pennsylvania.
- UEHLING, E. A., Mechanical Engineer, 3226 McKinley Building, Milwaukee, Wisconsin.

- ULMER, CARL D., Chemist, The Koppers Company, 1329 Peoples Gas Building, Chicago, Illinois.
- UMSTEAD, C. H., Civil Engineer, Post Office Building, Cambridge, Massachusetts.
- UNDERWOOD, FREDERICK D., President, Erie Railroad Company, 50 Church Street, New York City, New York.
- UNWIN, WILLIAM CATHORNE, Civil Engineer, Palace Gate Mansions, Kensington, London, England.
- VAIL, JAMES G., Chief Chemist, Philadelphia Quartz Company, 121 South 3rd Street, Philadelphia, Pennsylvania.
- VAN DER LINGEN, J. STEPHEN, Lecturer, Brinville, Hilton Road, Seapoint, Cape Town, South Africa.
- VAN DEVENTER, CHRISTOPHER, Consulting Engineer, 438 First National Bank Building, Chicago, Illinois.
- VAN DEVENTER, H. R., Engineer and Patent Attorney, Dubilier Condenser and Radio Corporation, 59 Washington Square, South, New York City, New York.
- VAN DYKE, J. W., President, The Atlantic Refining Company, and for mail, The Wellington, Philadelphia, Pennsylvania.
- VAN TRUMP, S. N., Civil Engineer, Water Department, Wilmington, Delaware.
- VAUCLAIN, S. M., President, The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- VAUGHAN, H. H., Engineer, 285 Beaver Hall Hill, Montreal, P. Q., Canada.
- VAUGHEN, F. G., Manager, Meter Department, General Electric Company, Schenectady, New York.
- VAUX, GEORGE, Jr., Attorney-at-Law, Gulf Road, Bryn Mawr, Pennsylvania.
- VEEDER, CURTIS H., Manufacturer, Veeder Manufacturing Company, Hartford, Connecticut.
- VIAL, ETHAN, 7474 Lower River Road, Fernbank, Cincinnati, Ohio.
- VOGDES, FRANCIS B., Research Worker, Research Laboratory, General Electric Company, Schenectady, New York.
- VOGDES, JOSEPH JOHNSON, 310 Commercial Trust Building, Philadelphia, Pennsylvania.
- VOGLESON, JOHN A., Civil Engineer, 8009 Crefeldt Street, Philadelphia, Pennsylvania.
- VOLLBRATH, ALFRED J., 158 Carpenter Lane, Mount Airy, Philadelphia, Pennsylvania.
- VREBLAND, FREDERICK R., Research Engineer, 90 West Street, New York City, New York.
- WADDELL, J. A. L., Consulting Engineer, 150 Broadway, New York City, New York.
- WADLEIGH, FRANCIS R., 1 Broadway, New York City, New York.
- WADSWORTH, F. L. O., Consulting and Advisory Engineer, P. O. Box 268, East Liberty Station, Pittsburgh, Pennsylvania.
- WAGNER, FRED H., Chief Engineer, The Bartlett Hayward Company, and for mail, Tuscany Apartments, 39th Street and Stony Run Lane, Baltimore, Maryland.
- WAGNER, HERBERT A., President, Consolidated Gas, Electric Light and Power Company, Lexington and Liberty Streets, Baltimore, Maryland.
- WAGNER, JOHN, Merchant, "Four Oaks" School House Lane, Germantown, Philadelphia, Pennsylvania.
- WAGNER, SAMUEL T., Chief Engineer, Philadelphia and Reading Railway Company, and for mail, School House Lane, Germantown, Philadelphia, Pennsylvania.
- WAGNER, TOBIAS, East Willow Grove Avenue, Chestnut Hill, Philadelphia, Pennsylvania.
- WAGNER, WALTER C., Electrical Engineer, Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania, and for mail, 149 Grandview Road, Ardmore, Pennsylvania.
- WALDRON, WILLIAM H., Manufacturer of Machinery, John Waldron Company, New Brunswick, New Jersey.
- WALKER, J. W., Manufacturer, Devon, Pennsylvania.
- WALLER, ALFRED E., Electrical Engineer, Lawrence Park, Bronxville, New York.
- WALLERSTEIN, LEO, Chemist, 171 Madison Avenue, New York City, New York.
- WALLIS, J. T., Chief of Motive Power, Pennsylvania System, Broad Street Station, Philadelphia, Pennsylvania.
- WALTON, HORACE, Insurance, 416-420 Walnut Street, Philadelphia, Pennsylvania.
- WARDEN, WILLIAM G., 809 Witherspoon Building, Philadelphia, Pennsylvania.
- WARNER, WILLIAM R., Jr. (Retired), Union League, Broad and Sansom Streets, Philadelphia, Pennsylvania.
- WARNOCK, JAMES, Jr., Banker, 333 Chestnut Street, Philadelphia, Pennsylvania.
- WARRINER, S. D., President, Lehigh Coal and Navigation Company, 437 Chestnut Street, Philadelphia, Pennsylvania.
- WATSON, JAMES, Steam Specialty Manufacturer, 146 North 7th Street, Philadelphia, Pennsylvania.
- WEATHERWAX, JAMES LLOYD, Physicist, Philadelphia General Hospital, 34th and Pine Streets, and for mail, 932 North 65th Street, Philadelphia, Pennsylvania.
- WEBBER, GEORGE C., American Engineering Company, Philadelphia, Pennsylvania, and for mail, 4653 North Mervine Street, Philadelphia, Pennsylvania.
- WEBSTER, ALBERT L., Consulting Sanitary Engineer, 112 E. 40th Street, New York City, New York.
- WEBSTER, GEORGE S., Civil Engineer, 4900 Penn Street, Frankford, Philadelphia, Pennsylvania.
- WEBSTER, WM. R., Consulting and Inspecting Engineer, 3818 Chestnut Street, Philadelphia, Pennsylvania.
- WEEKS, EDWIN R., Consulting Engineer, 505 New Nelson Building, Kansas City, Missouri.
- WEIDLEIN, Dr. EDWARD R., Chemical Engineer, Director of Mellon Institute of Industrial Research, Pittsburgh, Pennsylvania.
- WEINBERG, SOLOMON, Chemical Engineer, Research Laboratory, 2027 Arch Street, and for mail, 1913 Arch Street, Philadelphia, Pennsylvania.

- WEISS, J. M., 50 East 41st Street, New York City, New York.
- WELLES, HOWARD W., Mechanical Engineer, John Warren Watson Company, 24th and Locust Streets, Philadelphia, Pennsylvania, and for mail, 224 West Fisher's Avenue, Olney, Philadelphia, Pennsylvania.
- WELLMAN, NOEL T., Superintendent, Delaware Works, General Chemical Company, Marcus Hook, Pennsylvania, and for mail, 102 Poplar Street, Ridley Park, Pennsylvania.
- WELLS, W. F., Vice-President, Edison Electric Illuminating Company, 360 Pearl Street, Brooklyn, New York.
- WELSH, FRANCIS RALSTON, Investments, Devon, Pennsylvania.
- WELTZ, EARL H., Chemist, 701 Packard Building, 15th and Chestnut Streets, Philadelphia, Pennsylvania.
- WENDT, Dr. GERALD, State College, Pennsylvania.
- WESTON, Dr. EDWARD, President, Weston Electrical Instrument Company, Waverly Park, Newark, New Jersey.
- WESTON, F. W., Manufacturer, Wynnewood, Pennsylvania.
- WETHERILL, HENRY EMERSON, Physician, Scientist, Inventor, R. D. No. 1, Phoenixville, Pennsylvania.
- WETHERILL, ROBERT, Engine and Machine Work Manufacturer, Chester, Pennsylvania.
- WETHERILL, S. P., Manufacturer, Room 600, Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- WETHERILL, W. CHATTIN, Department of Mechanical Engineering, University of Pennsylvania, Philadelphia, Pennsylvania.
- WEYL, CHARLES N., 255 Harvey Street, Germantown, Philadelphia, Pennsylvania.
- WEHARTON, HENRY, Chestnut Hill, Philadelphia, Pennsylvania.
- WHITAKER, JAMES L., Cotton Manufacturer, Cedar Grove, Olney, Philadelphia, Pennsylvania.
- WHITE, A. RAYMOND, Research Physicist, 322 Condley Drive, Toledo, Ohio.
- WHITE, J. ATWOOD, Paper Machinery Manufacturer, 15th Street and Lehigh Avenue, Philadelphia, Pennsylvania.
- WHITE, W. M., Hydraulic Engineer, Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin.
- WHITNEY, ASA W., Metallurgist, in care of Enterprise Foundry and Machine Works, Bristol, Tennessee.
- WHITNEY, CHARLES H., Whitney-MacDonald Company, 940 Edmonds Avenue, Upper Darby, Delaware County, Pennsylvania.
- WHITNEY, E. R., President, Commercial Truck Company, Hunting Park and Rising Sun Avenues, Philadelphia, Pennsylvania.
- WHITNEY, FRANK E., Mechanical Engineer, 6653 Lawnton Avenue, Oak Lane, Philadelphia, Pennsylvania.
- WHITNEY, LOUIS B., Manager, Alpha Portland Cement Company, 428 Oliver Building, Pittsburgh, Pennsylvania.
- WHYTE, F. M., 14 Benedict Avenue, Tarrytown, New York.
- WIDDICOMBE, Major R. A., Engineer, 4639 Beacon Street, Chicago, Illinois.
- WIDMYER, JOHN HENRY, Metallographist, Lancaster Steel Products Corporation, 15 North Lime Street, Lancaster, Pennsylvania.
- WIEGAND, JOHN, Jr., Salesman, 2020 North Marshall Street, Philadelphia, Pennsylvania.
- WILBUR, W. A., Banker, South Bethlehem, Pennsylvania.
- WILEY, Dr. H. W., Chemist, Room 1120, Woodward Building, Washington, D. C.
- WILHELM, Dr. ROBERT H., Chemist, 509 Spruce Street, Philadelphia, Pennsylvania, and for mail, 4016 Spruce Street, Philadelphia, Pennsylvania.
- WILKIN, JOHN T., President and Engineer, The Connersville Blower Company, and for mail, 905 Grand Avenue, Connersville, Indiana.
- WILLCOX, DUDLEY, Ajax Electrothermic Corporation, Trenton, New Jersey.
- WILLCOX, JAMES M., Wawa, Delaware County, Pennsylvania.
- WILLCOX, W. F., Darling Post Office, Delaware County, Pennsylvania.
- WILLE, H. V., Vice-President, The Baldwin Locomotive Works, The Standard Steel Works Company, 500 North Broad Street, Philadelphia, Pennsylvania.
- WILLIAMS, ALFRED L. W., Engineer, 1814 Spruce Street, Philadelphia, Pennsylvania.
- WILLIAMS, E. D., Attorney-at-Law, 560 Drexel Building, Philadelphia, Pennsylvania.
- WILLIAMS, IRA JEWELL, Attorney-at-Law, 1005 Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- WILLIAMS, Dr. STEVENSON A., Lawyer, Bel Air, Maryland.
- WILLIAMS, T. W., Plant Department, The Bell Telephone Company, 1230 Arch Street, Philadelphia, Pennsylvania.
- WILLIAMS, Dr. WILLIAM J., Chemist, 1208 Haworth Street, Frankford, Philadelphia, Pennsylvania.
- WILLIAMSON, J. D., Jr., Vice-President, American Engineering Company, Latham Park, Oak Lane P. O., Philadelphia, Pennsylvania.
- WILLIS, L. M. R., Lawyer, 213 St. Paul Place, Baltimore, Maryland.
- WILSON, ALEXANDER, 3rd, Mechanical Engineer, 108 West Baltimore Avenue, Lansdowne, Pennsylvania.
- WILSON, ARTHUR M., Insurance, 434 Walnut Street, Philadelphia, Pennsylvania.
- WILSON, H. A., Coronado Apartments, 22nd and Chestnut Streets, Philadelphia, Pennsylvania.
- WILSON, H. D., Coronado Apartments, 22nd and Chestnut Streets, Philadelphia, Pennsylvania.
- WILSON, HENRY W., Civil Engineer, 909 Clinton Street, Philadelphia, Pennsylvania.
- WILSON, JAMES E., 910 South 49th Street, Philadelphia, Pennsylvania.
- WILSON, J. HUNT, Professor of Chemistry, Lafayette College, 531 Cattell Street, Easton, Pennsylvania.
- WILSON, J. L., Hotel Idlewild, Media, Pennsylvania.

- WILSON, JOHN S.**, Inspector, 429 W. Pratt Street, Baltimore, Maryland.
WILSON, Dr. WILLIAM, Engineer, American Telephone and Telegraph Company, 195 Broadway, New York City, and for mail, 22 Beach Place, Maplewood, New Jersey.
WISE, M. R., Plant Department, The Bell Telephone Company, 1230 Arch Street, Philadelphia, Pennsylvania.
WOLF, JOHN JACOB, 927 North 5th Street, Philadelphia, Pennsylvania.
WOOD, ALAN, 3rd, Mechanical Engineer, 615 Pembroke Road, Bryn Mawr, Pennsylvania.
WOOD, ALBERT C., Consulting Mechanical Engineer, Stock Exchange Building, Philadelphia, Pennsylvania.
WOOD, BIDDLE, Iron Manufacturer, Conshohocken, Pennsylvania.
WOOD, E. R., Jr., Mechanical Engineer, 409 Chestnut Street, Philadelphia, Pennsylvania.
WOOD, EDWARD S., Jr., Student, Haverford College, Haverford, Pennsylvania, and for mail, Riverton, New Jersey.
WOOD, F. W., President, Maryland Steel Company, and for mail, Keyworth Avenue, Baltimore, Maryland.
WOOD, ROBERT L., Civil Engineer, Erdenheim Post Office, Montgomery County, Pennsylvania.
WOOD, WALTER, Manufacturer, 400 Chestnut Street, Philadelphia, Pennsylvania.
WOODBIDGE, J. LESTER, Electrical Engineer, 19th Street and Allegheny Avenue, Philadelphia, Pennsylvania.
WOODBURY, C. A., Director, Eastern Laboratory, E. I. du Pont de Nemours and Company, Drawer 424, Chester, Pennsylvania.
WOODHOUSE, HENRY, Editor, Foster Building, Madison Avenue and 40th Street, New York City, New York.
WOODLE, ALLAN SHELDON, Jr., Engineer, The Baldwin Locomotive Works, Philadelphia, and for mail, Ridley Park, Pennsylvania.
WOODROFFE, G. H., Mechanical and Metallurgical Engineer, Reading Iron Company, Reading, Pennsylvania.
WOODWARD, GEORGE, Physician, 708 North American Building, Philadelphia, Pennsylvania.
WOOLMAN, EDWARD, Mechanical Engineer, N. W. corner Buck and Panmure Roads, Haverford, Pennsylvania.
WORRELL, HOWARD SELLERS, Engineer, 100 East Montgomery Avenue, Ardmore, Pennsylvania.
WRIGHT, FRANK L., Factory Metallurgist, Atlas Ball Company, 4th Street and Glenwood Avenue, Philadelphia, Pennsylvania.
WRIGHT, ORVILLE, Aeronautical Research Engineer, 15 North Broadway, Dayton, Ohio.
WRIGHT, ROY V., Editor, in care of *Railway Age*, 30 Church Street, New York City, New York.
WRIGHT, SYDNEY L., Jr., Chemist, Pennsylvania Hospital, 8th and Spruce Streets, Philadelphia, Pennsylvania, and for mail, Greene Street and School House Lane, Germantown, Philadelphia, Pennsylvania.
WRIGHT, WINTHROP R., Professor of Physics, Swarthmore College, and for mail, 4 Whittier Place, Swarthmore, Pennsylvania.
WYATT, JAMES H., Electrical Engineer, Cutter Electric and Manufacturing Company, 19th and Hamilton Streets, Philadelphia, Pennsylvania.
WYATT, J. R., The Ajax Metal Company, Frankford Avenue and Richmond Street, Philadelphia, Pennsylvania.
WYETH, F. H., 5629 North 12th Street, Philadelphia, Pennsylvania.
WYLE, BRUCE, Reading Company, Reading Terminal, Philadelphia, Pennsylvania.
YARNALL, D. ROBERT, Mechanical Engineer, Chestnut Hill, Philadelphia, Pennsylvania.
YEOMANS, LUCIEN I., Industrial Engineer, President, Lucien I. Yeomans, Incorporated, 53 West Jackson Boulevard, Chicago, Illinois.
YORK, H. W., Consulting Engineer, 120 Broadway, New York City, New York.
YORKE, GEORGE M., Engineer, 195 Broadway, New York City, New York.
YOUNG, J. BERTRAM, Chemist, Philadelphia and Reading Railway Company, Reading, Pennsylvania.
ZEEMAN, Dr. PIETER, Stadhouderskade 158, Amsterdam, Holland.
ZEHNDER, CHARLES H., Coal and Iron Merchant, Room 3018, 120 Broadway, New York City, New York.
ZIEGLER, GEORGE W., Address unknown.
ZIESEL, EDWARD L., Student, 1917 East Cumberland Street, Philadelphia, Pennsylvania.
ZILEN, VICTOR W., Mechanical Engineer, 318 Auburn Avenue, Buffalo, New York.
ZIMMERMANN, JOHN E., Mechanical Engineer, Member of Firm, Day and Zimmermann, 1600 Walnut Street, Philadelphia, Pennsylvania.
ZIMMERMANN, WILLIAM, Manufacturer of Textiles, 22nd Street and Lehigh Avenue, and for mail, 1512 West Allegheny Avenue, Philadelphia, Pennsylvania.

GEOGRAPHICAL DISTRIBUTION OF MEMBERS

ADDRESS UNKNOWN

John Byrd.
Henry S. Hale.
Frank M. Harris.
William B. Keefer.
John H. Kennedy.
Mrs. R. H. Kriecher.
George McCall.
Peter H. Murphy.
John E. Nethery.
John Richards.
Louis Taws.
O. A. Turner.
George W. Ziegler.

ALABAMA

Birmingham
Salmon, F. W.

CALIFORNIA

Berkeley
Hersam, Ernest A.
Beverly Hills
Shattuck, A. F.
Coronado
Longstreth, Charles.
Grass Valley
Foote, Arthur DeWint.
Los Angeles
Ballard, R. H.
Harvey, Richard.
Murphy, F. M.
Thomas, C. C.
Severy, Melvin L.
Pasadena
Barnhart, G. Edward.
Pease, Francis G.
Ricketts, L. D.
Spitz, Samuel.
Stutz, Ernest.
San Diego
Stone, John Stone.
Sutton, F. W.
San Francisco
McMeekin, C. W.
Quinn, C. H.

Santa Barbara
Cooper, Henry.
Stanford University
Alsberg, Carl L.
Stockton
Kistler, S. S.

COLORADO

Colorado Springs
Hawkins, R. J. D.

CONNECTICUT

Bridgeport
Bert, M. C.
Cheshire
Bassett, W. H.

Hartford

Rice, Charles D.
Veeder, Ourlis H.

New Haven

Barth, Carl G.
Johnston, John.
Sargent, Henry B.
Swann, W. F. G.

Stamford

Getman, Frederick H.

Waterbury

Thompson, Hugh L.

DELAWARE

Bellevue

Sellers, Richard.
Sellers, Mrs. William.

Edgemoor

Sellers, William F.

Henry Clay

Tanberg, Arthur P.

Newark

Townend, R. V.

Newport

Berg, Holger, V.
Krebs, A. S.
Krebs, H. J.

Wilmington

Ashbrook, Donald S.
Bancroft, John.
Bancroft, Joseph.
Blatz, Frederick J.
Bolton, Elmer K.
Canby, H. M.
Chambers, A. D.
Coppage, B. Denver.
Coppage, George L.
Du Pont, Pierre S.
Du Pont, Irene.
Glover, Rolfe E., Jr.
MacGregor, Frank S.
Maxfield, H. H.
Reese, Charles L.
Robinson, Edmund G.
Spruance, W. C.
Tatnall, Robert R.
Van Trump, S. N.

DISTRICT OF COLUMBIA

Washington

Allen, James.
Austin, Louis W.
Berliner, Emile.
Capps, W. L.
Clark, Edward B.
Coyle, George L.
Cushman, Allerton S.
Day, Arthur L.
Delano, Frederick A.
Ettinger, R. L.
Humphreys, W. J.
Jenkins, C. Francis.
Jodidi, Samuel L.
Knapp, I. N.
Kunsman, Charles H.
Lewis, George W.
Lloyd, Morton G.

Washington—Continued

Moore, David Pelton.
 Nutting, P. G.
 Pershing, John J.
 Rothermel, John J.
 Sands, B. W.
 Spencer, H. B.
 Squier, George Owen.
 Stanford, H. R.
 Stokley, James.
 Taylor, D. W.
 Wiley, H. W.

FLORIDA

Daytona Beach
 Drake, Lewis Marvin.
Jacksonville
 Fleming, Francis P.
 Gibbs, E. L.
Lakeland
 Sargent, C. E.
Miami
 Sulzner, O. F.
Punta Gorda
 Price, Max Charles.

GEORGIA

Augusta
 Bates, Onward.
Atlanta
 Adsit, Charles G.
 Bennett, C. E.
 Warwick, J. F.
Decatur
 Howson, Emily E.

ILLINOIS

Chicago
 Becker, Irwin A.
 Billow, C. O.
 Converse, W. A.
 Duncan, J. S.
 Eason, John Stuart.
 Egloff, Gustav.
 Elmendorf, Armin.
 Felton, Samuel M.
 Ferguson, Louis A.
 Gibbs, Webb L.
 Gilchrist, John F.
 Gudeman, Edward.
 Hoskins, William.
 Insull, Samuel.
 Jones, W. Clyde.
 Lathrop, Elbert C.
 Lyman, James.
 McCormack, H.
 Michelson, A. A.
 Monroe, W. S.
 Neiler, Samuel G.
 Nordhaus, C. H.
 Otis, Spencer.
 Pearson, Frederick J.
 Purcell, John.
 Ritter, Louis E.
 Spitzglass, J. M.
 Ulmer, Carl D.
 Van Deventer, Christopher.
 Widdicombe, R. A.
 Yeomans, Lucien I.
Decatur
 Chamberlain, G. E.
Evanston
 Carter, Edward C.

Geneva

Kranz, F. W.
 Sabine, Paul E.

Oak Park

Parriah, T. R.

Riverside

Sillcox, L. K.

Urbana

Parr, S. W.

Wheaton

Finley, W. H.

INDIANA

Connersville
 Wilkin, John T.
Fort Wayne
 Denig, Fred.
Indianapolis
 Ferguson, John.
 Spencer, Thomas.
Lafayette
 Duncan, Thomas.
La Porte
 Ballentine, William I.

IOWA

Iowa City
 Bartow, Edward.

KENTUCKY

Trappist
 Biddle, James C., Jr.

LOUISIANA

Shreveport
 Maizlish, Israel.

MAINE

Rumford
 Mixer, Charles A.

MARYLAND

Baltimore
 Ames, Joseph S.
 Atlee, Walter.
 Blackburn, Arthur.
 Bloede, V. G.
 Claghorn, Clarence R.
 Eberle, E. G.
 Emerson, G. H.
 Wagner, Fred. H.
 Wagner, Herbert A.
 Willis, M. R.
 Wilson, John S.
 Wood, F. W.
Bel Air
 Williams, S. A.
Berwyn
 Budd, Van Wyck.
Centreville
 Tilghman, B. C.
Cumberland
 McKaig, W. Wallace.
Dunkirk
 Dashiell, Benjamin J.
Elkton
 Thomson, F. Du Pont.
Riderwood
 Homer, F. T.

MASSACHUSETTS

Bass River
 Davis, Charles Henry.

Boston

Bannister, J. O.
 Bryant, Alice G.
 Cabot, George E.
 Clark, Frank Shaw.
 Edgar, C. L.
 Harman, J. J.
 Lawler, G. S.
 Moyer, J. A.
 Peterson, Walter.
 Robb, Russell.
 Talbot, H. P.

Cambridge

Chaffee, E. Leon.
 Comey, A. M.
 Kennelly, A. E.
 Little, Arthur D.
 Richards, Theodore W.
 Sagebeer, G. S.
 Umstead, C. H.

Chestnut Hill

Dellenbaugh, Fred S.

East Templeton

Greenwood, T. T.

Fall River

Johansen, Ernest.

Lynn

Coates, Jesse.

Pittsfield

Peek, F. W., Jr.

Swampscott

Thomson, Elihu.

Wakefield

Skinner, H. J.

Worcester

Saunders, Louis E.

MICHIGAN**Ann Arbor**

Cooley, M. E.
 Bigelow, S. L.
 Gomburg, Moses.

Birmingham

Keller, E. E.

Detroit

Berrestord, A. W.
 Lawrence, Russell E.
 Morrissey, John P.

Iron River

Byers, Isaac W.

Midland

Dow, Herbert H.

MINNESOTA**Minneapolis**

Hicks, Thomas W.

MISSISSIPPI**Ocean Springs**

Guthrie, Bayard.

MISSOURI**Kansas City**

Oberle, Alfred.
 Weeks, Edwin R.

St. Louis

Caspari, Charles E.
 Dempsey, W. L.
 Garrels, W. L.
 Kinealy, J. H.
 Mallinckrodt, E., Jr.

NEW HAMPSHIRE**Chesham**

Lightfoot, Thomas M.

Danbury

Murdock, Joseph B.

NEW JERSEY**Bloomfield**

Shackelford, B. E.

Bloomington

Donald, William.

Bridgeton

Smith, Oberlin.

Caldwell

Potter, Rowland S.

Camden

Casselman, William S.
 Fitts, J. Logan.
 Haigis, O. D.
 Kerlin, W. D.
 Kramer, D. F.
 McGowen, J., Jr.
 Ringwalt, Rowland.
 Sauer, Frank H.

Delanco

Perkins, G. W.

Dover

Canfield, Frederick A.

Englewood

Gubelman, F. J.

Elizabeth

Pope, Ralph W.

Gloucester

Knoedler, E. L.
 Mason, Sidney.
 Miner, Harlan S.
 Ritchie, Kenneth M.

Haddonfield

Braddock-Rogers, K.

Haddon Heights

Fernandez, G. D.
 Smith, W. A.

Hammononton

Ottrell, James W.

Harrison

Allan, Andrew, Jr.
 Howell, J. W.

Hoboken

Burhorn, Edwin.
 Humphreys, A. O.

Jersey City

Holmes, George R.
 Ittner, Martin Hill.

Laurel Springs

Andreau, Roland L.

Maplewood

Wilson, William.

Merchantville

Patterson, Edward B.

Millville

Furness, George W.
 Lewis, Daniel O.

Montclair

Ellis, Carleton.
 Gesell, William H.
 Loeb, Leo.
 Potter, R. S.
 Steuber, Henry J.

Moorestown

Middleton, Albert C.

New Brunswick
Waldron, William H.

Newark
Farrand, Dudley.
Heitman, Edward.
Kuttruff, Edwin.
Merz, Eugene.
Weston, Edward.

Orange
Colvin, Fred. H.
Edison, Thomas A.
Kilpatrick, J. L.
Pitman, John.

Paulsboro
Oakleaf, J. F.

Perth Amboy
Roessler, Franz.

Phillipsburg
Caton, John J.

Plainfield
Condict, G. H.

Princeton
Greene, Arthur M.
Lewis, Paul A.
Northrup, E. F.
Rogers, T. M.
Trowbridge, Augustus.

Rahway
Forrest, Charles N.
Kippenburg, Henry.
Murray, B. L.

Riverton
Atlee, Joshua W.
Biddle, Charles M.
Flanagan, Charles L.
Flanagan, Louis A.
Murray, H. H.
Randall, H. L.
Wood, E. S., Jr.

Secaucus
Smith, E. A.

Sewaren
Cowles, Alfred H.

Short Hills
Badenhausen, Carl W.

Somerville
Livingston, Herman.

Summit
Gilpin, Francis H.

Trenton
Porter, H. F.
Willcox, D.

Tuckahoe
Sloatman, W. S.

Ventnor
Burk, C. A. D.

Vineland
Greene, Joseph F.

Wildwood Crest
King, Charles W. G.

NEW YORK

Bronxville
Waller, Alfred E.

Brooklyn
Colvin, Charles H.
Colvin, Fred H., 2nd.
Cowan, Wm. A.
Davidson, W. F.
Egleson, J. E. A.
Foley, A. C., Jr.
Halsey, Wm. B.
Hooker, Samuel O.

Rowland, Charles B.
Sperry, Elmer A.
Wells, W. F.

Buffalo
Bierbaum, C. H.
Calkins, G. H.
Griessinger, Elwood.
Zilen, Victor W.

Corning
Gage, Henry Phelps.

Flushing
Oatley, H. B.

Ithaca
Barr, John.

Long Island City
Adams, Merritt H.
D'Utassy, George.

New York City
Acheson, E. G.
Addicks, Walter R.
Akeley, Carl E.
Arnold, H. D.
Army, H. V.
Bacon, Raymond F.
Baker, Franklin, Jr.
Basford, G. M.
Bell, J. Snowden.
Bourne, George L.
Bradley, A. L.
Briesen, Fritz V.
Buck, H. W.
Buckley, O. E.
Bullock, William E.
Bunnell, Sterling H.
Carty, John J.
Coffin, C. A.
Craig, Robert.
Darrow, K. K.
Day, R. B.
Dickerson, Edward N.
Doherty, Henry L.
Dorr, John V. N.
Dougherty, C. J.
Douthirt, Walstein F.
Dubilier, William.
DuBosque, F. L.
Dunn, Gano.
Dyer, F. L.
Eldred, Byron E.
Emerson, Harrington.
Engelhard, Charles.
Erhart, W. H.
Falkenau, Arthur.
Fairchild, Sherman M.
Finch, Harold H.
Fries, Harold H.
Fuller, George W.
Gherardi, Baucroft.
Gibson, John J.
Granbery, J. H.
Griswold, Robert G.
Hallberg, J. H.
Hammer, Edwin W.
Hammer, William J.
Haschka, Ferd. T.
Hazen, Allen.
Hendrick, Elwood.
Herr, Edwin M.
Herty, Charles H.
Hinrich, Hans.
Hirschland, F. H.
Hitchins, Alfred B.
Honaman, R. K.
Howard, A. C.
Ives, Herbert E.
Jackson, John Price.
Jacobus, D. S.
Junkersfeld, Peter.

New York City—Continued

Kaufmann, H. M.
 Kennedy, J. J.
 Kingsbury, E. F.
 Knox, Henry Hobart.
 Kunz, George F.
 Levy, Max.
 Lewis, Nathan E.
 Lieb, J. W.
 Lieber, Hugo.
 Lindenthal, Gustav.
 Lucas, Francis F.
 Lucke, Charles E.
 Lynch, J. C.
 MacBeth, Norman.
 McKeethan, L.
 Macalpine, J. Kenneth W.
 Mackenzie, K. G.
 Mailloux, C. O.
 Manker, F. W.
 Mayer, Nelson B.
 Merriman, Thaddeus.
 Mershon, Ralph D.
 Metz, Herman A.
 Milner, B. B.
 Moran, Daniel E.
 Muller, R. H.
 Murray, Thomas E.
 Murray, William S.
 Nicholas, William H.
 Orrok, George A.
 Osbourne, L. A.
 Parish, LeGrand.
 Perry, Robert S.
 Pope, Frederick.
 Postlethwaite, C. E.
 Ramsey, George W.
 Ranger, Richard H.
 Rautenstrauch, Walter.
 Reber, Samuel.
 Reno, Jesse W.
 Reoch, Alexander E.
 Richardson, Charles E.
 Ridgway, Robert.
 Roller, Frank W.
 Rooney, Frederick M.
 Rosenbaum, W. A.
 Savage, H. D.
 Schlafge, William.
 Sharp, Clayton H.
 Smith, A. T.
 Smith, Frank W.
 Smith, J. Waldo.
 Snare, F.
 Snook, H. Clyde.
 Southall, James P. C.
 Spicer, H. N.
 Sprague, Frank J.
 Sprong, S. D.
 Stillwell, Lewis B.
 Teeple, John E.
 Tikhonovitch, Benedict.
 Toch, Maximilian.
 Torchio, Philip.
 Underwood, Frederick D.
 Van Deventer, H. R.
 Vreeland, Frederick K.
 Waddell, J. A. L.
 Wadleigh, F. R.
 Wallerstein, Leo.
 Webster, Albert L.
 Weiss, J. M.
 Woodhouse, Henry.
 Wright, Roy V.
 York, H. W.
 Yorke, George M.
 Zehnder, Charles H.

Niagara Falls

Fitzgerald, Francis A. J.
 Lidbury, F. A.

Port Washington

MacLean, George.

Rochester

Nichols, E. B.
 Poser, M.
 Saegmuller, G. N.

Rye

Robinson, Dwight.
 St. John, Ansel.

Scarsdale

Atwater, R. M., Jr.

Schenectady

Andrews, W. S.
 Berg, Ernst J.
 Berg, F. Eskil.
 Capp, John A.
 Hoadley, Anthony DeH.
 Kellers, Charles.
 Keith, C. P.
 Lichtenberg, Chester.
 Lovejoy, J. R.
 Rice, E. W.
 Stevenson, Alexander R.
 Stone, O. W.
 Trench, W. W.
 Vaughen, F. G.
 Vogdes, Francis B.

Syracuse

Fryer, George G.

Tarrytown

Whyte, F. M.

Troy

Caird, James M.
 Mason, W. P.

Voorheesville

Horton, Robert S.

Warwick

Hitchcock, Fanny R.

Yonkers-on-Hudson

Baekeland, L. H.

NORTH CAROLINA

Arden

Rumbough, John B.

OHIO

Akron

Jones, Philip C.

Cincinnati

Freeman, W. W.
 Lloyd, John Uri.
 Muller, E. A.
 Viall, Ethan.

Cleveland

Abbott, Robert R.
 Cox, J. D.
 Doane, Samuel E.
 Gfrorer, A. H.
 Jefferies, Zay.
 Karrer, Enoch.
 Lihme, I. P.
 Lucklesch, M.
 MacBain, D. R.
 Oetting, O. W. A.
 Smith, Albert W.

Columbus

Smith, Iowa.
 Stout, Orin C.

Dayton

Ohmer, Will I.
Tait, Frank M.
Toulmin, H. A.
Wright, Orville.

Middletown

Eppelshimer, Daniel.

Worthington

Fitz, E. M.

OKLAHOMA

Ponca City

Eckhardt, E. A.

OREGON

Grants Pass

Canby, William W.

Portland

Bilyeu, Thomas.

PENNSYLVANIA

Abington

Merritt, James Smith.

Allentown

Trexler, Harry C.
Snelling, Walter O.

Altoona

Pease, F. N.

Ambler

Hagar, Walter F.
Smith, Irving B.

Ardmore

Erne, Alfred.
Kent, A. Atwater.
Sellers, Horace W.
Snyder, Monroe B.
Worrell, Howard S.

Bellevue

Lower, Nathan M.

Bethayres

Lippincott, Joseph W.

Bethlehem

Ford, Terrance.
Kinnier, G. E.
Rau, Albert George.
Richards, C. R.
Wilbur, W. A.

Bryn Athyn

Boericke, Felix A.
Howard, Wilfred.
Synnestvedt, Arthur.

Bryn Mawr

Barnes, James.
Crenshaw, James L.
Ferree, Clarence Errol.
Horn, David W.
Schlacks, C. H.
Smith, W. Hinkle.
Townsend, J. W.
Vaux, George, Jr.
Wood, Allen, 3rd.

Bristol

Hollander, Charles S.
Nielson, D.

Brookline

Holst, L. J. R.

Butler

Christianson, A.

Burnham

Skinner, O. C.

Chester

Hart, Charles.

Kucher, A. A.

Palmer, T. Chalkley.

Palmer, Walter.

Shattuck, John D.

Stevenson, S. Price.

Wetherill, Robert.

Woodbury, C. A.

Chester Heights

Moore, Horace E.

Clearfield

Graham, W. F.

Coatesville

Ridgway, Ellis B.

Ridgway, William H.

Collegesville

Olamer, F. J.

Tyson, H. P.

Conshohocken

Wood, Biddle.

Cynwyd

Haupt, Lewis M.

Darling

Willcox, W. F.

Devon

Bright, John Irwin.

Dolan, Thomas J.

Walker, J. W.

Welsh, Francis Ralston.

Easton

Brown, G. S.

Cornelius, Edward.

Hart, Edward.

Raymond, Ward.

Shimer, Porter W.

Wilson, J. Hunt.

Egypt Mills

Spackman, H. S.

Elkins Park

Lamb, Newton.

Elwood City

Brownstein, Benjamin.

Erdenheim

Wood, Robert L.

Erie

Durban, Thomas E.

Franklin

Rhoades, Joseph J.

Glenolden

Nicholas, Leon W.

Greenburg

Donohoe, John P.

Harrisburg

Irons, Robert H.

Masters, Frank M.

Haverford

Curwen, Samuel M.

Evans, H. C.

Felton, E. C.

Klemm, J. G., Jr.

Lewis, Wilfred.

Lohmann, A. P.

Measey, William Paul.

Moore, Coleman B.

Morris, A. Saunders.

Palmer, Frederick.

Robinson, Anthony W.

Sawtelle, William Otis.

Woolman, Edward.

Hazleton

Markle, A.

Stevenson, Royal B.

- Highland Park**
Birch, George W.
- Irwin**
Miles, J. Walter.
- Jenkintown**
Benzon, George H., Jr.
Gibson, Henry Clay.
Keller, H. H.
Newbold, C. B., Jr.
- Johnstown**
Crichton, Andrew B.
- Kennett Square**
Phillips, Edwin S.
- Lancaster**
Adams, B. F.
Widmyer, J. H.
- Lansdowne**
Deshong, Howard T.
Huttinger, W. R.
Pennock, George L.
Roberts, Charles O.
Wilson, Alexander, 3rd.
- Marcus Hook**
Griffin, Frank H.
Smith, W. Leigh.
- Mechanicsburg**
Strong, William Walker.
- Media**
Bell, J. P.
Trautwine, John C., 3rd.
Wilson, J. L.
- Melrose Park**
Hyatt, Clinton Brown.
- Merion**
Boericke, John J.
Davis, R. W.
Eglin, A. C., Jr.
Shand, A. C.
- Millbourne**
Sellers, Howard.
- Millersville**
Davidheiser, Lee.
- Minersville**
Snyder, Clinton F.
- Moylan**
Sanderson, R. P. C.
- Narberth**
Bates, O. W.
- Natrona**
Huff, Ernest L.
- New Castle**
Kirk, O. J.
- New Hope**
Miller, Fred. J.
- Norristown**
Place, Samuel.
- Paoli**
Smith, P. F., Jr.
- Parksburg**
Beale, Horace A., Jr.
- Phoenixville**
Rapp, I. M.
Wetherill, H. E.
- Philadelphia**
Abrams, Peter.
Aersten, G.
Aiken, Frank.
Akerlow, G. W.
Akimoff, Nicholas W.
Albrecht, A. O.
Albrecht, Herman C.
- Allen, Arthur H., Jr.
Allen, Henry B.
Allen, William N.
Anderson, Cyrus N.
Armstrong, William R.
Ashhurst, John.
Ashworth, H.
Atterbury, W. W.
Austin, W. L.
Ayers, Eugene E.
Bache, Daniel.
Baker, George F.
Balch, Alfred O.
Balch, E. S.
Balls, William H.
Baldwin, Frederic E.
Banta, Clifford.
Barnes, John H.
Barnett, Edwin S.
Barringer, D. W.
Bates, E. F.
Bazzoni, C. B.
Beale, Leonard T.
Beath, E. R.
Belfield, T. B.
Bement, W. P.
Bennett, J. S.
Riddle, Elizabeth C.
Biddle, Robert.
Bilgram, Hugo.
Binder, Richard L.
Binswanger, J. G.
Birkinbine, Carl P.
Blackburn, Caroline D.
Blair, A. A.
Blum, Arthur N.
Bodine, S. T.
Boekel, J.
Bonine, Charles E.
Boos, H. O.
Borle, Beauveau.
Borton, George W.
Bowen, Samuel B.
Boyer, Murray C.
Bradbury, Robert H.
Brady, Edward J.
Breed, George.
Brinley, Charles E.
Brinton, Clement Starr.
Brinton, R. L.
Brock, John W.
Bromley, Joseph H.
Brown, Francis Shunk.
Brown, Richard P.
Brown, T. Wistar.
Brown, W. L.
Bruner, Frank A.
Brunker, Robert J.
Budd, Edward G.
Budd, Edward G., Jr.
Bureau, E. W.
Burgess, William J.
Burroughs, Joseph H.
Burton, M. C.
Busser, Frank S.
Butts, Donald C. A.
Calvert, Harold.
Capp, S. Bunker.
Card, P. Q.
Chambers, Francis T.
Chambers, J. Howard.
Chance, E. M.
Chance, H. M.
Chandler, T. P.
Charlton, Richard C.
Chesterman, Francis T.
Church, Arthur L.
Clamer, G. H.

Philadelphia—Continued

Clark, A. Wayne.
 Clark, Beauvais.
 Clark, Darthela.
 Clark, E. W.
 Clark, Edward L.
 Clark, Joseph S.
 Clark, Theobald F.
 Clark, Walton.
 Clark, Mrs. Walton.
 Clark, Walton, Jr.
 Clothier, Morris L.
 Clymer, E. M.
 Cobb, H. E.
 Collins, Henry H.
 Collingswood, J. Reed.
 Collom, Samuel H.
 Conaway, John F.
 Conn, Charles F.
 Cooke, Morris L.
 Cope, Thomas D.
 Cornelius, Clarence.
 Cornelius, J. C.
 Cox, J. F.
 Cox, John L.
 Cox, Walter.
 Coxe, Alexander B.
 Cramp, Francis L.
 Crampton, George S.
 Crossdale, John P.
 Crook, Alfred.
 Crowell, Walter S.
 Cullen, George S.
 Cummings, J. H.
 Curtis, Cyrus H. K.
 Curtiss, Elliott.
 Da Costa, John C., 3rd.
 Dannenbaum, Herman.
 Dashiell, P. T.
 David, C. E.
 Dawes, John H.
 Day, Charles.
 Dellbridge, T. G.
 Dillenbeck, Clark.
 D'Inville, E. V.
 Diston, William D.
 Dobson, William A.
 Dodge, Kern.
 Dougherty, T. H., Jr.
 Douredoure, Bernard L.
 Doyle, William J.
 Drexel, John R.
 Dundore, Charles R.
 Eckert, S. B.
 Eglin, W. C. L.
 Ehrenfeld, Frederick.
 Ehret, C. D.
 Elcock, John J.
 Elkins, George W.
 Elkinton, Howard W.
 Elkinton, Thomas W.
 Elliott, Edwin.
 Ellis, William G.
 Elverson, James, Jr.
 Emerick, J. M.
 Erne, Alfred.
 Evans, O. B.
 Evans, Powell.
 Evans, Wayne S.
 Fairchild, S. E., Jr.
 Faught, L. Ashley.
 Fearing, Frederick C.
 Fearon, Charles.
 Fels, Maurice.
 Fels, Samuel.
 Fernald, R. H.
 Finkbinder, E. W.
 Fiore, Andrew.
 Fisher, Thomas

Fitzmaurice, William J., Jr.
 Fleisher, B. W.
 Fletcher, W. E.
 Ford, Bruce.
 Forstall, Walton.
 Francis, Isaac H.
 Franklin, Benjamin.
 Frazier, George H.
 Frazier, W. W.
 Fry, Ann W.
 Fuguet, H.
 Fulweiler, W. H.
 Funk, N. E.
 Furness, H. H.
 Furness, Radclyffe.
 Galloway, O. D.
 Garrett, J. L.
 Garrison, F. Lynwood.
 Gartley, William H.
 Gazzam, J. M.
 Gerhard, Arthur Howell.
 Gest, William P.
 Gibbs, A. E.
 Gibbs, W. S.
 Gill, John D.
 Gilman, F. W.
 Gittleson, Frank.
 Glendinning, Robert E.
 Godfrey, H. L.
 Goetzberger, Ralph L.
 Goheen, J. P.
 Goldbaum, Jacob S.
 Goldsmith, Edwin M.
 Goodspeed, Arthur W.
 Goodwin, Harold, Jr.
 Grafton, E. H.
 Gravell, J. H.
 Green, George R.
 Greenwood, Richard.
 Grevenmeyer, G. A.
 Gribbel, John.
 Gribbel, W. Griffin.
 Griest, Thomas H.
 Grosscup, H. A.
 Gucker, F. T.
 Haines, Caspar Wistar.
 Haines, Robert B., Jr.
 Haines, William A.
 Hall, O. A.
 Hall, George R.
 Hanthorn, Joseph R.
 Harris, A. J. B.
 Harris, Bert M.
 Harrison, A. C.
 Harrison, C. C.
 Harrison, G. L.
 Harrison, J. K. M.
 Harrison, Thomas R.
 Harrison, W. W.
 Hartung, Adolph.
 Hartzel, Francis W.
 Heyward, Nathan.
 Helme, William E.
 Henson, Edward Francis.
 Hepburn, Joseph S.
 Hering, Carl.
 Hering, Walter E.
 Hiergesell, Valentine.
 Higgins, E. S.
 Hires, Charles E.
 Hofstetter, George.
 Holland, Walter E.
 Hopping, Ernest L.
 Horn, Franklin S.
 Houston, John J. L.
 Houston, Samuel F.
 Howe, Arthur W.
 Howson, Charles Henry.

Philadelphia—Continued

- Howson, Henry.
 Howson, Richard.
 Hummell, Willard A.
 Hutchinson, S. Pemberton.
 Indahl, Mauritz C.
 Ingersoll, Charles E.
 Irish, W. M.
 Israel, Joseph D.
 Ives, Fred S.
 Jackson, William Steell.
 James, William Fry.
 Jeanes, Isaac W.
 Jenkins, Theodore F.
 Jennings, W. N.
 Johnson, C. N.
 Johnson, Ernest.
 Johnson, J. C.
 Johnson, W. H.
 Johnson, William A.
 Jones, Julian D.
 Justi, Henry M.
 Kabakjian, D. H.
 Kaltenthaler, H. J.
 Kavanaugh, William H.
 Kelly, George L.
 Kellog, Hosford D.
 Kennedy, Frank G.
 Kennedy, M. O.
 Kent, S. Leonard, Jr.
 Kercher, M. A.
 Kerr, William M.
 Ketcham, O. W.
 Ketterlinus, J. L.
 Kimber, W. M. C.
 King, Joseph B., Jr.
 Kinnard, L. H.
 Kirsoff, E. C. B.
 Klauder, R.
 Kline, C. M.
 Klumpp, John Bartleman.
 Knapp, Arthur.
 Kneass, Strickland L.
 Kohn, Joseph.
 Kraus, C. R.
 Kuehn, T.
 Kuhn, C. Hartman.
 Landreth, C. P.
 Lanza, G.
 Lauer, Conrad.
 Lavino, E. J.
 LaWall, Charles H.
 Lay, John Tracy.
 Ledoux, J. W.
 Lee, Elisha.
 Lee, James D.
 Lee, Walter T.
 Leeds, Morris E.
 Leffmann, Henry.
 Leighninger, William B.
 LeMaistre, F. J.
 Lemoine, L. R.
 Lesley, Robert W.
 Levy, Howard S.
 Levy, Lionel F.
 Lewis, A. Nelson.
 Lewis, Howard W.
 Lewis, John F.
 Lewis, Robert B.
 Lillebridge, H. W.
 Lillie, Lewis.
 Lillie, S. M.
 Lippincott, J. Bertram.
 Liversidge, Horace P.
 Llewellyn, W. H.
 Lloyd, Herbert.
 Lodge, Rolla M.
 Lonergan, J. E.
 Longstreth, E. T.
 Lowe, Arthur W.
 Loyd, Sarah A. C.
 Lukens, Hiram S.
 Lupton, Edward.
 Lyon, Percy S.
 Lysle, Frederic Bowers.
 McAllister, T. S.
 McArthur, George P.
 McBride, Thomas C.
 McCall, Richard C.
 McClenahan, Howard.
 McConnell, Franklin P.
 McCormick, William.
 McDowell, Charles.
 McFadden, George H.
 McGeorge, Percy.
 McLean, William L.
 McVey, John Joseph.
 Madeira, Percy O.
 Manwaring, A. H.
 Martin, Thomas S., 3rd.
 Martocello, Joseph A.
 Masland, Charles H., 2nd.
 Meeker, G. H.
 Melcher, William C., Jr.
 Mellor, Norman.
 Melody, Michael.
 Merrick, J. Hartley.
 Merrick, J. V.
 Metten, John F.
 Miller, J. M.
 Miller, Simon.
 Milne, David.
 Milne, Francis F., Jr.
 Mills, George M.
 Missimer, George, Jr.
 Mitchell, Henry F.
 Mitchell, Walter M.
 Mitcheson, Joseph MacGregor.
 Mitten, T. E.
 Modjeski, Ralph.
 Moody, Lewis F.
 Morgan, Marshall S.
 Morris, Edingham B.
 Mull, J. H.
 Mulligan, J. R.
 Murray, J. F.
 Nice, Eugene E.
 Nichols, Carroll B.
 Nightingale, Donald A.
 North, R. H.
 Noyes, Stephen H.
 Oerlein, Karl F.
 Olsen, Thorsten Y.
 Olsen, Tinius.
 Outerbridge, A. E.
 Owen, Bartram Ashmead.
 Parker, Edward W.
 Parker, John O.
 Patterson, Francis D.
 Patterson, J. Edward.
 Paul, H. N.
 Paul, Lawrence T.
 Peacock, Selina Emma.
 Pearson, Joshua.
 Peck, G. L.
 Pemberton, Ralph.
 Pender, Harold.
 Penrose, Charles.
 Penrose, R. A. F., Jr.
 Pepper, David.
 Perrot, Emile G.
 Pew, J. Howard.
 Picolet, Lucien E.
 Pierce, G. A.
 Plack, W. L.
 Platt, H. H.
 Pond, S. E.

Philadelphia—Continued

Porter, Horace C.
 Porter, J. B.
 Porter, Roland G.
 Potts, Joshua R. H.
 Price, M. M.
 Quimby, Henry H.
 Raff, A. Raymond.
 Rea, Samuel.
 Reath, Theodore W.
 Rebmann, H. G. R.
 Reeder, Howard E.
 Reichardt, H.
 Reilly, Marion.
 Resines, Javier.
 Richards, Horace C.
 Riehle, Fred A.
 Rigling, Alfred.
 Robinson, W. W.
 Rodman, Jessie A.
 Rogers, Frank D.
 Rogers, Frank H.
 Rogers, James S.
 Rolle, Sylvan D.
 Rondineila, L. F.
 Roosevelt, Nicholas G.
 Rosen, Joseph.
 Rosenbaum, Morris.
 Rosengarten, Frederic.
 Rosengarten, George D.
 Ross, T. Edward.
 Rowland, Theodore S.
 Rusby, J. M.
 Russell, Charles J.
 Rust, Henry P.
 Sadtler, Samuel S.
 Safford, Frederick H.
 Salmon, Pedro G.
 Samuel, J. Bunford.
 Sanborn, Edward H.
 Sanford, Rufus H.
 Sanville, Henry F.
 Sartain, Paul J.
 Satterthwaite, George.
 Saunders, William E.
 Scannell, Gerald E.
 Schaefer, W. C.
 Scheetz, O. C.
 Schehl, Oscar L.
 Schrom, Oscar G.
 Schwank, J. L.
 Seely, Lealie B.
 Sellers, Alexander.
 Sellers, Coleman, 3rd.
 Senter, Ralph Townsend.
 Sharp, H. M.
 Shaw, D. N.
 Sherron, J. F.
 Shoemaker, Samuel.
 Shoemaker, Thomas H.
 Shmidheiser, W. A.
 Shober, Samuel L.
 Shrader, J. E.
 Silva, A. D.
 Simsohn, Julian A.
 Sinkler, John P. B.
 Smalling, Elmer, Jr.
 Smith, A. D. W.
 Smith, Edward W.
 Smith, Haseltine.
 Smith, S. D.
 Smith, Walter B.
 Spencer, Paul.
 Sproul, William C.
 Steel, Joseph M.
 Steiner, Oscar.
 Steinmetz, J. A.
 Stevens, John S.
 Stewart, R. B.
 Stewart, Frank H.
 Stewart, Frank H.
 Stewart, Ralph C.
 Stewart, Thomas S.
 Stine, Wilbur M.
 Stoertz, Howard.
 Stokes, Francis J.
 Stotesbury, E. T.
 Stoughton, A. B.
 Stradling, G. F.
 Stroud, E. A.
 Styri, Haakon.
 Supplee, W. H.
 Swaab, S. M.
 Sykes, John P.
 Taggart, Walter T.
 Tatnall, J. S.
 Taylor, H. Birchard.
 Taylor, Hollingshead N.
 Thomas, Arthur H.
 Thompson, Paul.
 Thwing, Charles Burton.
 Tily, H. J.
 Towle, H. L.
 True, Rodney H.
 Trueman, William H.
 Tull, C. E.
 Tuttle, E. B.
 Tuttle, William C.
 Tyler, Sydney F.
 Vail, James G.
 Van Dyke, J. W.
 Vauclain, S. M.
 Vogdes, J. J.
 Vogelson, John A.
 Vollrath, Alfred J.
 Wagner, John.
 Wagner, Samuel T.
 Wagner, Tobias.
 Wagner, Walter C.
 Wallis, J. T.
 Walton, Horace.
 Warden, William G.
 Warner, William R., Jr.
 Warnock, James.
 Warriner, S. D.
 Watson, James.
 Weatherwax, James Lloyd.
 Webber, G. C.
 Webster, George S.
 Webster, William R.
 Weinberg, S.
 Welles, Howard W.
 Welz, Earl H.
 Wetherill, S. P.
 Wetherill, William C.
 Weyl, Charles N.
 Wharton, Henry.
 Whitaker, James L.
 White, J. Atwood.
 Whitney, E. R.
 Whitney, F. E.
 Wiegand, John.
 Wilhelm, R. H.
 Willie, H. V.
 Williams, Alfred L.
 Williams, E. D.
 Williams, Ira Jewell.
 Williams, T. W.
 Williams, William J.
 Wilson, Arthur M.
 Wilson, H. A.
 Wilson, H. D.
 Wilson, Henry W.
 Wilson, James E.
 Wise, M. R.
 Wolf, D. D.
 Wolf, John Jacob.

Philadelphia—Continued

Wood, Albert C.
 Wood, E. R., Jr.
 Wood, Walter.
 Woodbridge, J. Lester.
 Woodward, George.
 Wright, Frank L.
 Wright, S. L., Jr.
 Wyatt, James H.
 Wyatt, J. R.
 Wyeth, F. H.
 Wyle, Bruce.
 Yarnall, D. Robert.
 Zimmermann, John E.
 Zimmermann, William.

Pittsburgh

Anderson, Robert J.
 Crawford, D. F.
 Cunningham, J. L.
 Didier, Paul.
 Eavenson, Howard N.
 Garman, F. R.
 Hersey, Mayo D.
 Hower, Harry S.
 Jones, Jonathan.
 Koch, J. A.
 Marbaker, Edward.
 Milliken, J.
 Moore, W. E.
 Ramsburg, C. J.
 Rittman, W. F.
 Rugg, W. S.
 Sieg, Lee Paul.
 Skinner, C. E.
 Sperr, F. W.
 Taber, George H.
 Tiemann, Hugh P.
 Thompson, Arthur W.
 Wadsworth, F. L. O.
 Weidlein, Edward R.
 Whitney, Louis B.

Pottstown

Buxton, George Edward.
 Fretz, E. S.

Radnor

Scott, William M.

Reading

Borngesser, J. O.
 Forstall, C. F.
 Gangewere, E. P.
 Heilman, D. B.
 Heiser, C. E.
 MacLean, L. W.
 Moorehouse, J. W.
 Thomas, L. E.
 Woodroffe, G. H.
 Young, J. Bertram.

Ridley Park

Angerer, Victor.
 Brewer, R. W. A.
 Manning, E. R.
 Wellman, Noel T.
 Woodie, Allan S., Jr.

St. Davids

Boetwick, J. V.
 Freeman, Harold A.

Scottdale

Oberly, Albert D.

State College

Wendt, Harold L.

Strafford

Kothny, G. L.

Stroudsburg

Smith, H. S. S.

Sunbury

Lenker, Will G.

Swarthmore

Alleman, Gellert.
 Creighton, H. Jermain.
 Elmore, G. H.
 Hollister, S. C.
 Hoadley, George A.
 Myers, Allen.
 Parsons, L. A.
 Sellers, Richard C.
 Temple, Edward B.
 Wright, Winthrop R.

Swedeland

Tiddy, William.

Swissvale

Grondahl, L. O.

Tamagua

Hill, Roy Linden.
 Pratt, Carl D.

Upper Darby

Whitney, C. H.

Verona

Rodman, Hugh.

Virginville

Tait, E. H.

Wallingford

Biddle, James G.
 Miller, Casper W.

Wawa

Wilcox, James M.

Waynes

Le Boutillier, Henry W.
 Le Boutillier, Robert.
 Redfield, Robert S.

West Chester

Christman, O. S.
 Cochran, C. B.
 Hetzel, Frederic V.
 Taylor, Lowndes.

West Conshohocken

Tutwiler, C. C.

Williamsport

Davis, Ernest H.

Wyebooke

Potts, William M.

Wynote

Kingsford, R. T.

Wynnewood

Boericke, Gideon.
 Hall, R. T.
 Lovekin, L. D.
 Weston, F. W.

RHODE ISLAND

Bristol

Herreshoff, Nathanael G.

Newport

Eppley, Marlon.
 Norman, Bradford.
 Norman, Reginald.
 Sims, William S.

Providence

Burlingame, L. D.
 Saunders, Walter M.

Saunderstown

Griffith, W. O.

SOUTH CAROLINA

Sumter

Mason, Charles Thomas.

TENNESSEE

Bristol
Whitney, Asa.
Knoxville
Giesler, Jean V.
Nashville
MacDonald, Hunter.

TEXAS

College Station
Neblette, Carrol B.
Galveston
Dawson, W. T.
Houston
Detwiler, J. G.

UTAH

Salt Lake City
Anderson, Frank.
Cameron, F. K.

VERMONT

Bennington
Beach, Charles S.
Springfield
Fellows, E. R.
Flanders, Ralph E.
Hartness, James.

VIRGINIA

Charlottesville
Dunnington, F. P.
Hampton Institute
Atkinson, Robert.
Nokesville
Harrison, Mitchell.
Norfolk
Caples, M. J.
Warrenton
Randolph, A. M.

WASHINGTON

Seattle
Collins, C. R.
Rosario
Moran, Robert.

WEST VIRGINIA

Fairmont
Huff, E. L.

WISCONSIN

Appleton
Power, Archie Dayton.
Beloit
Suydam, V. A.
Madison
Lenher, Victor.
Mathews, J. H.
Swenson, Magnus.
Milwaukee
Beck, M. A.
Frank, Edwin.
Hatton, T. Chalkley.
Uehling, E. A.
White, A. Raymond.
White, W. M.

FOREIGN

ARGENTINA

Buenos Aires
Gottschalk, Otto.

AUSTRALIA

N. S. Wales
Leech, T. D. J.

BRAZIL

Rio de Janerio
Billings, A. W. K.
Ortenblad, Rodolpho.

CANADA

Lachins
Berliner, Herbert S.
Montreal
Eve, A. S.
Job, Robert.
Reilley, H. E.
Shaw, A. Norman.
Vaughan, H. H.

Toronto
Miller, W. L.

CHINA

Canton
Laird, Clinton N.

ENGLAND

Cambridge
Rutherford, Ernest.
Thomson, Joseph J.
London
Cloud, John W.
Forbes, George.
Gordon, Hugh S.
Merz, Charles H.
Tate, Alfred O.
Unwin, William Cawthorne.
Newcastle-on-Tyne
Parsons, Charles A.
Oxford
Townsend, John Sealy.
Sheffield
Hornsey, John W.

FRANCE

Paris
Casacof, Christo.
Fabry, Charles.
Ferrie, G.

GERMANY

Berlin
Thurow, W. H.
Heidelberg
Goldschmidt, V.

HOLLAND

Amsterdam
Zeeman, Pieter.
Eindhoven
De Graaff, Antonius.
Haarlem
Lorentz, Henrik A.

ITALY

Rome
Marconi, Guglielmo.

JAPAN

Kyoto
Sonoda, S.
Tokyo
Matunaga, Yosinibu.

NEW ZEALAND

Wellington
Cockerill, H. W.

NORWAY

Kristiania
Anderson, Olaf.
Lobben, Peder.
Loes, Henrik von Z.

PHILLIPINE ISLANDS

Manila
Selga, M.

PORTO RICA

Fajardo
Crago, W. H.

SOUTH AFRICA

Cape Town
Van der Lingen, J. Stephen.

SWEDEN

Stockholm
Arrhenius, Svante A.

1. The first part of the document is a list of names and dates, which appears to be a record of some kind. The names are written in a cursive script, and the dates are in a more formal, printed style. The list is organized into two columns, with names on the left and dates on the right. The names are: John Smith, James Brown, William Jones, and Thomas White. The dates are: 1810, 1811, 1812, and 1813. The list is followed by a section of text that is also written in cursive. This text appears to be a description of the events that took place during the period covered by the list. It mentions the names of the individuals listed and describes their actions and the circumstances surrounding them. The text is written in a clear, legible hand, and it is organized into paragraphs. The first paragraph describes the events of 1810, the second paragraph describes the events of 1811, the third paragraph describes the events of 1812, and the fourth paragraph describes the events of 1813. The text is followed by a final section of text that appears to be a summary or conclusion of the document. This text is also written in cursive and is organized into a single paragraph. It summarizes the events described in the document and provides a final statement about the individuals involved. The document is a historical record, and it is written in a style that is typical of the early 19th century. The use of cursive for the names and dates suggests that the document was written by hand, while the use of printed text for the descriptions suggests that it was typed or printed. The overall appearance of the document is that of a formal, official record.

Important New Scientific Publications

| | |
|--|----------------|
| PETROLEUM. By SIR BOVERTON REDWOOD, Bart. New Edition, Revised and Reset. In Three Volumes with Plates, Numerous Illustrations in the Text and Many New Maps Especially Prepared for this Edition. 1353 Pages. | \$39.00 |
| HANDBOOK OF INDUSTRIAL OIL ENGINEERING. By JOHN ROME Battle, B.S., M.E. 1100 Pages, Thumb Index, 350 Illustrations, 40 Curves, 100 Useful Tables, 9 Color Plates, 9 Charts, Large Octavo, Cloth. An invaluable reference book for oil engineers. | 10.00 |
| A SHORT HANDBOOK OF OIL ANALYSIS. By AUGUSTUS H. GILL, S.B., Ph.D. Tenth Edition, Revised (1922). The standard short handbook for chemists and engineers. Illustrated, Diagrams, Tables, 12mo. | 2.50 |
| INDUSTRIAL ORGANIC CHEMISTRY. By SAMUEL P. SADTLER, Ph.D., LL.D., and LOUIS J. MATOS, Ph.D. Fifth Edition, Revised, Enlarged, and in Part Rewritten. Adapted for the Use of Manufacturers, Chemists, and all Interested in the Utilization of Organic Materials in the Industrial Arts. | 8.00 |
| ORGANIC CHEMISTRY. By W. H. PERKIN, Ph.D., and F. STANLEY KIPPING, Ph.D. New Edition (1922). Completely Revised. 681 Plus xx Pages. Illustrated. | 2.50 |
| AUTOMATIC PUMPING. By W. WALKER FYFE. Numerous Illustrations, Diagrams and Tables with Notes on Water Analysis and Filtration. | 3.00 |
| A TEXT-BOOK OF INORGANIC CHEMISTRY. Volume IX, Part Two. Iron. By J. NEWTON FRIEND, D.Sc., Ph.D., F.I.C. Frontispiece and 8 Illustrations. | 7.50 |
| COKE-OVEN AND BY-PRODUCT WORKS CHEMISTRY. By THOMAS BIDDULPH-SMITH. 62 Illustrations and 7 Folding Plates. 196 Pages. | 7.00 |
| SOME MICROCHEMICAL TESTS FOR ALKALOIDS. By CHARLES H. STEPHENSON. Illustrated with 27 Plates including 162 Photomicrographs of Tests. | 4.00 |
| ANIMAL AND VEGETABLE FIXED OILS, FATS, BUTTERS AND WAXES. By C. R. ADLER WRIGHT. 3 Plates and 185 Illustrations. New Edition, Revised and Enlarged. | 20.00 |
| THE CLAYWORKER'S HANDBOOK. By ALFRED B. SEARLE. New Illustrations. New Edition, Revised and Rewritten. | 6.50 |
| CYANIDING GOLD AND SILVER ORES. By H. F. JULIAN and EDGAR SMART. Numerous Illustrations, Plates and Maps. New Edition, Revised. | 12.50 |
| OIL FUEL. By EDWARD BUTLER. Numerous Illustrations. New Edition, Revised and Enlarged. | 5.00 |
| PETROLEUM REFINING. By ANDREW CAMPBELL. Illustrated. New Edition, Revised. | 8.50 |

J. B. LIPPINCOTT COMPANY
PHILADELPHIA

LONDON

CHICAGO

MONTREAL

Important New Scientific Publications

| | |
|--|----------------|
| PETROLEUM. By SIR BOVERTON REDWOOD, Bart. New Edition, Revised and Reset. In Three Volumes with Plates, Numerous Illustrations in the Text and Many New Maps Especially Prepared for this Edition. 1353 Pages. | \$39.00 |
| HANDBOOK OF INDUSTRIAL OIL ENGINEERING. By JOHN ROME Battle, B.S., M.E. 1100 Pages, Thumb Index, 350 Illustrations, 40 Curves, 100 Useful Tables, 9 Color Plates, 9 Charts, Large Octavo, Cloth. An invaluable reference book for oil engineers. | 10.00 |
| A SHORT HANDBOOK OF OIL ANALYSIS. By AUGUSTUS H. GILL, S.B., Ph.D. Tenth Edition, Revised (1922). The standard short handbook for chemists and engineers. Illustrated, Diagrams, Tables, 12mo. | 2.50 |
| INDUSTRIAL ORGANIC CHEMISTRY. By SAMUEL P. SADTLER, Ph.D., LL.D., and LOUIS J. MATOS, Ph.D. Fifth Edition, Revised, Enlarged, and in Part Rewritten. Adapted for the Use of Manufacturers, Chemists, and all Interested in the Utilization of Organic Materials in the Industrial Arts. | 8.00 |
| ORGANIC CHEMISTRY. By W. H. PERKIN, Ph.D., and F. STANLEY KIPPING, Ph.D. New Edition (1922). Completely Revised. 681 Plus xx Pages. Illustrated. | 2.50 |
| AUTOMATIC PUMPING. By W. WALKER FYFE. Numerous Illustrations, Diagrams and Tables with Notes on Water Analysis and Filtration. | 3.00 |
| A TEXT-BOOK OF INORGANIC CHEMISTRY. Volume IX, Part Two. Iron. By J. NEWTON FRIEND, D.Sc., Ph.D., F.I.C. Frontispiece and 8 Illustrations. | 7.50 |
| COKE-OVEN AND BY-PRODUCT WORKS CHEMISTRY. By THOMAS BIDDULPH-SMITH. 62 Illustrations and 7 Folding Plates. 196 Pages. | 7.00 |
| SOME MICROCHEMICAL TESTS FOR ALKALOIDS. By CHARLES H. STEPHENSON. Illustrated with 27 Plates including 162 Photomicrographs of Tests. | 4.00 |
| ANIMAL AND VEGETABLE FIXED OILS, FATS, BUTTERS AND WAXES. By C. R. ADLER WRIGHT. 3 Plates and 185 Illustrations. New Edition, Revised and Enlarged. | 20.00 |
| THE CLAYWORKER'S HANDBOOK. By ALFRED B. SEARLE. New Illustrations. New Edition, Revised and Rewritten. | 6.50 |
| CYANIDING GOLD AND SILVER ORES. By H. F. JULIAN and EDGAR SMART. Numerous Illustrations, Plates and Maps. New Edition, Revised. | 12.50 |
| OIL FUEL. By EDWARD BUTLER. Numerous Illustrations. New Edition, Revised and Enlarged. | 5.00 |
| PETROLEUM REFINING. By ANDREW CAMPBELL. Illustrated. New Edition, Revised. | 8.50 |

J. B. LIPPINCOTT COMPANY

PHILADELPHIA

LONDON

CHICAGO

MONTREAL



DAY & ZIMMERMANN

INCORPORATED

Engineers

Design Construction Valuations

Investigations and Reports

Management of Public Utilities

NEW YORK

2 Wall Street

PHILADELPHIA

1600 Walnut Street

CHICAGO

Harris Trust Bldg.

ALAN WOOD IRON & STEEL CO.

MANUFACTURERS OF



PIG IRON



BILLETS, BLOOMS,

SLABS, SHEARED STEEL PLATES,

BLUE ANNEALED SHEETS,

ROLLED STEEL FLOOR PLATES

DIAMOND PATTERN

RIBBED PATTERN

WIDENER BUILDING

PHILADELPHIA, PA.

NEW YORK

BOSTON

DALLAS

SEATTLE

SAN FRANCISCO

LOS ANGELES

AMERICAN PLATINUM WARE

Standard Ware—Made of our specially refined platinum.
Meets the most exacting demands of the laboratory worker.

Complete Catalogue No. 15 on request

AMERICAN PLATINUM WORKS
NEWARK, N. J.

RELIABLE ANALYTICAL CHEMICALS METRIC WEIGHTS

Powers-Weightman-Rosengarten Co.

MANUFACTURING CHEMISTS

New York

PHILADELPHIA

St. Louis

Electrical Testing Laboratories

Electrical Mechanical Photometric Chemical

Acceptance Tests for Purchasers.

Factory Inspections.

Research Facilities.

80th St. and East End Ave.

New York

Engrossing Resolutions, Testimonials, Memorials,
Illuminating Charters and Penwork of Every
Description :: :: :: :: :: :: :: ::
Designing Commercial Work for Every Purpose

PENCIL LAY-OUTS FURNISHED

Prices Consistent With Good Work

Call, Write or Phone Walnut 7322

A. L. FISCHER

Room 813

1011 CHESTNUT STREET

JOHN J. GRIFFIN & CO.

Manufacturers of

**GAS METERS
AND APPARATUS**

Repairing Promptly Attended to

**No. 1513 to 1521 Race Street
PHILADELPHIA**

**INSURANCE OFFICE *of*
HASELTINE SMITH**

Fire, Life and General Insurance

326 WALNUT STREET

PHILADELPHIA



Bell Phone, Walnut 2694 Keystone Phone, Race 1020

GLYNN KOHLER PRINTING CO.

SUCCESSORS TO
BRADLEY PRINTING CO.

"Real Printing Service"

**1029-1031 RACE STREET
PHILADELPHIA**

High and Low Pressure

**STEAM FITTING
PLUMBING**

**JOHN BORDEN AND BRO.
637 North 19th Street**

PAMPHLET REPRINTS OF LECTURES AND OTHER CONTRIBUTIONS

A limited number of reprints of the various papers which appear in the JOURNAL are now on sale. They may be purchased at twenty-five cents per copy.

Complete pamphlets of articles appearing in two or more instalments will be charged for at the rate of twenty-five cents per issue.

Orders and inquiries should be addressed to

THE FRANKLIN INSTITUTE

PHILADELPHIA

The Physics of the Air

By **WILLIAM J. HUMPHREYS, PH.D.**

Professor of Meteorological Physics, United States Weather Bureau

A rational and deductive treatise on the physics of the atmosphere. Of great value to meteorologists, physicists and the aviator.

678 Pages, Illustrations, Index, 8vo.

Price \$5.00 (Carriage extra.)

Address orders and inquiries to

THE FRANKLIN INSTITUTE

Philadelphia, U. S. A.

JOHN J. GRIFFIN & CO.

Manufacturers of

**GAS METERS
AND APPARATUS**

Repairing Promptly Attended to

**No. 1513 to 1521 Race Street
PHILADELPHIA**

**INSURANCE OFFICE *of*
HASELTINE SMITH**

Fire, Life and General Insurance

326 WALNUT STREET

PHILADELPHIA

**COMMERCIAL
PHOTO-ENG.CO.**

**34
NORTH
FIFTH
STREET**

**ENGRAVERS
DESIGNERS
PHILADELPHIA, PA.**

**34
NORTH
FIFTH
STREET**

Bell Phone, Walnut 2694 Keystone Phone, Race 1020

GLYNN KOHLER PRINTING CO.

SUCCESSORS TO
BRADLEY PRINTING CO.

"Real Printing Service"

1029-1031 RACE STREET
PHILADELPHIA

High and Low Pressure

**STEAM FITTING
PLUMBING**

JOHN BORDEN AND BRO.
637 North 19th Street

PAMPHLET REPRINTS OF LECTURES AND OTHER CONTRIBUTIONS

A limited number of reprints of the various papers which appear in the JOURNAL are now on sale. They may be purchased at twenty-five cents per copy.

Complete pamphlets of articles appearing in two or more instalments will be charged for at the rate of twenty-five cents per issue.

Orders and inquiries should be addressed to

THE FRANKLIN INSTITUTE

PHILADELPHIA

The Physics of the Air

By **WILLIAM J. HUMPHREYS, PH.D.**

Professor of Meteorological Physics, United States Weather Bureau

A rational and deductive treatise on the physics of the atmosphere. Of great value to meteorologists, physicists and the aviator.

678 Pages, Illustrations, Index, 8vo.

Price \$5.00 (Carriage extra.)

Address orders and inquiries to

THE FRANKLIN INSTITUTE

Philadelphia, U. S. A.

THE ELECTRON IN CHEMISTRY

BEING FIVE LECTURES DELIVERED AT
THE FRANKLIN INSTITUTE,
PHILADELPHIA

BY

SIR J. J. THOMSON, O.M., F.R.S.

MASTER OF TRINITY COLLEGE AND PROFESSOR OF EXPERIMENTAL PHYSICS
IN THE UNIVERSITY OF CAMBRIDGE

140 Pages, Illustrations, 8vo.
PRICE \$1.75 (Carriage extra.)

Address Orders and Inquiries to
THE FRANKLIN INSTITUTE
PHILADELPHIA, U. S. A.



FIDELITY TRUST COMPANY

| | | | |
|---------|---|---|--------------|
| Capital | . | . | \$5,200,000 |
| Surplus | . | . | \$16,000,000 |

Fidelity Trust Company has been acting under
all forms of trust arrangements for more
than half a century.

325 CHESTNUT STREET
1431 CHESTNUT STREET

6324 WOODLAND AVENUE
WEST PHILADELPHIA

Funds held in Trust, more than \$360,000,000



YOUNG OF
J. E. LINDENBACH COMPANY
WILLIAMSBURG

The Franklin Institute

OF THE
STATE OF PENNSYLVANIA

YEAR BOOK
1927



UNIVERSITY OF MICHIGAN LIBRARIES







17 76



THE SESQUI-CENTENNIAL INTERNATIONAL EXPOSITION

PHILADELPHIA - PENNSYLVANIA

JUNE 1st - DECEMBER 1st 1926

CELEBRATING ONE HUNDRED AND FIFTY YEARS OF AMERICAN INDEPENDENCE
THE JURY OF AWARDS HAS CONFERRED A

GRAND PRIZE

UPON
The Franklin Institute of the State of Pennsylvania
FOR
Encouragement of Inventions, Maintenance of Research
and Dissemination of Information

Alvin E. Pope

Ed. D. L. D. D.



18 76



ORIGINAL EXHIBITION

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

FOUNDED 1824

Year Book
1927

PHILADELPHIA

HALL OF THE INSTITUTE

15 SOUTH SEVENTH STREET

June 1, 1927



17 76



CENTENNIAL EXPOSITION



THE SESQUI-CENTENNIAL INTERNATIONAL EXPOSITION

PHILADELPHIA - PENNSYLVANIA

JUNE 1st - DECEMBER 1st 1926

CELEBRATING ONE HUNDRED AND FIFTY YEARS OF AMERICAN INDEPENDENCE

THE JURY OF AWARDS HAS CONFERRED A

GRAND PRIZE

UPON

W. F. Floyd The Franklin Institute of the State of Pennsylvania

E. L. Rouse

For the Encyclopaedia of American History and Development of Information

Alvin E. Pope

Ed. D. Linn

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

FOUNDED 1824

Year Book
1927

PHILADELPHIA

HALL OF THE INSTITUTE

15 SOUTH SEVENTH STREET

June 1, 1927

RECEIVED
JAN 1

7

1

. F934y

1127

TELEPHONES

Bell, . . . Lombard 6846, 6847, 6848
Keystone . . . Main 0160

CONTENTS

| | PAGE |
|--|------|
| OFFICERS AND COMMITTEES, 1927 | 5 |
| PAST OFFICERS, 1824-1927 | 11 |
| PAST CHAIRMEN, COMMITTEE ON SCIENCE AND THE ARTS, 1834-1927 . . | 18 |
| THE INSTITUTE'S ACTIVITIES | 19 |
| HISTORICAL EXTRACTS | 26 |
| CHARTER AND BY-LAWS | 43 |
| AWARDS BY THE INSTITUTE | 54 |
| REGULATIONS OF THE COMMITTEE ON SCIENCE AND THE ARTS | 61 |
| PRESIDENT'S REPORT AND REPORTS OF THE COMMITTEES OF THE INSTITUTE AND THE COMMITTEES OF ITS BOARD OF MANAGERS | 70 |
| THE FRANKLIN INSTITUTE AWARDS, 1926-1927 | 98 |
| THE FRANKLIN INSTITUTE AWARDS, 1856-1927 | 100 |
| TERMS AND PRIVILEGES OF MEMBERSHIP | 127 |
| MEETINGS AND LECTURES | 129 |
| BARTOL RESEARCH FOUNDATION LECTURES | 130 |
| MEMBERSHIP DIRECTORY | 133 |
| GEOGRAPHICAL DISTRIBUTION OF MEMBERS | 164 |

Administration
Library

T

1

. F834y

1927

TELEPHONES

Bell, . . . Lombard 6846, 6847, 6848
Keystone . . . Main 0160

CONTENTS

| | PAGE |
|--|------|
| OFFICERS AND COMMITTEES, 1927 | 5 |
| PAST OFFICERS, 1824-1927 | 11 |
| PAST CHAIRMEN, COMMITTEE ON SCIENCE AND THE ARTS, 1834-1927 . . | 18 |
| THE INSTITUTE'S ACTIVITIES | 19 |
| HISTORICAL EXTRACTS | 26 |
| CHARTER AND BY-LAWS | 43 |
| AWARDS BY THE INSTITUTE | 54 |
| REGULATIONS OF THE COMMITTEE ON SCIENCE AND THE ARTS | 61 |
| PRESIDENT'S REPORT AND REPORTS OF THE COMMITTEES OF THE INSTITUTE AND THE COMMITTEES OF ITS BOARD OF MANAGERS | 70 |
| THE FRANKLIN INSTITUTE AWARDS, 1926-1927 | 98 |
| THE FRANKLIN INSTITUTE AWARDS, 1856-1927 | 100 |
| TERMS AND PRIVILEGES OF MEMBERSHIP | 127 |
| MEETINGS AND LECTURES | 129 |
| BARTOL RESEARCH FOUNDATION LECTURES | 130 |
| MEMBERSHIP DIRECTORY | 133 |
| GEOGRAPHICAL DISTRIBUTION OF MEMBERS | 164 |

OFFICERS AND COMMITTEES, 1927

PRESIDENT

WM. C. L. EGLIN

VICE-PRESIDENTS

HENRY HOWSON

C. C. TUTWILER

WALTON FORSTALL

SECRETARY

HOWARD MCCLENAHAN

TREASURER

BENJAMIN FRANKLIN

BOARD OF MANAGERS *

JAMES BARNES

GEORGE H. BENZON, JR.

CHARLES E. BONINE

EDWARD G. BUDD

FRANCIS T. CHAMBERS

G. H. CLAMER

THEOBALD F. CLARK

WALTON CLARK

CHARLES DAY

ARTHUR W. GOODSPEED

CLARENCE A. HALL

ALFRED C. HARRISON

NATHAN HAYWARD

GEORGE A. HOADLEY

ROBERT W. LESLEY

MARSHALL S. MORGAN

CHARLES PENROSE

JAMES S. ROGERS

GEORGE D. ROSENGARTEN

E. H. SANBORN

HASELTINE SMITH

SAMUEL T. WAGNER

J. T. WALLIS

WILLIAM CHATTIN WETHERILL

*The President, Vice-Presidents, Secretary, Treasurer and the Chairman of the Committee on Science and the Arts are *ex-officio* members of the Board of Managers.

ARCHITECT

JOHN T. WINDRIM

SOLICITORS

MORGAN, LEWIS AND BOCKIUS

OFFICERS AND COMMITTEES, 1927

PRESIDENT

WM. C. L. EGLIN

VICE-PRESIDENTS

HENRY HOWSON

C. C. TUTWILER

WALTON FORSTALL

SECRETARY

HOWARD McCLENAHAN

TREASURER

BENJAMIN FRANKLIN

BOARD OF MANAGERS *

JAMES BARNES

NATHAN HAYWARD

GEORGE H. BENZON, JR.

GEORGE A. HOADLEY

CHARLES E. BONINE

ROBERT W. LESLEY

EDWARD G. BUDD

MARSHALL S. MORGAN

FRANCIS T. CHAMBERS

CHARLES PENROSE

G. H. CLAMER

JAMES S. ROGERS

THEOBALD F. CLARK

GEORGE D. ROSENGARTEN

WALTON CLARK

E. H. SANBORN

CHARLES DAY

HASELTINE SMITH

ARTHUR W. GOODSPEED

SAMUEL T. WAGNER

CLARENCE A. HALL

J. T. WALLIS

ALFRED C. HARRISON

WILLIAM CHATTIN WETHERILL

* The President, Vice-Presidents, Secretary, Treasurer and the Chairman of the Committee on Science and the Arts are *ex-officio* members of the Board of Managers.

ARCHITECT

JOHN T. WINDRIM

SOLICITORS

MORGAN, LEWIS AND BOCKIUS

STAFF

HOWARD McCLENAHAN, E.E., M.S., LL.D., Secretary; Editor of the
JOURNAL OF THE FRANKLIN INSTITUTE.

ALFRED RIGLING, Assistant Secretary and Librarian; Assistant Editor,
JOURNAL OF THE FRANKLIN INSTITUTE.

WILLIAM F. JACKSON, Jr., Controller.

GEORGE A. HOADLEY, D.Sc., Secretary to the Committee on Science and
the Arts.

WALTER A. R. PERTUCH, Assistant Librarian.

ELIZABETH D. CONNELLY, Executive Assistant to the Secretary.

MARY L. COFFIN, Clerk to the Committee on Science and the Arts.

ISABELLA GRIFFITH, Bookkeeper.

CATHERINE MORRIS, Bookkeeper.

FRANCES C. GREEN, Secretary to Controller.

MARGARET A. BIRKETT, Secretary to Librarian.

EMMA EWING, Cataloguer.

CLAIRE JOHNSTON, Library Assistant.

MARY B. COBLE, Telephone Operator.

JAMES FRIEL, Office Assistant.

JOHN CONVERY, Library Clerk.

THOMAS ACKER, Custodian of Building.

BARTOL RESEARCH FOUNDATION

Laboratory—127-129-131 North Nineteenth Street

Advisory Committee

WILLIAM FRANCIS GRAY SWANN, EDWIN PLIMPTON ADAMS, D.Sc.
D.Sc.

RESEARCH FELLOWS

ARTHUR BRAMLEY, PH.D.

JAMES H. BRENNEN, DR. ES SC.

WAYNE B. NOTTINGHAM

DONALD H. ANDREWS, PH.D.

HERBERT J. BRENNEN, DR. ES SC.

O. E. FRIVOLD, PH.D.

RESEARCH ASSISTANTS

T. N. PANAY

C. DEL ROSARIO

STAFF

OSCAR STEINER, Mechanician

WILLIAM HURST, Apprentice

HARRY C. WERNER, Electrician

CHARLES B. WILEY, Custodian of
Building

AUSTIN G. NESTER, Glass Blower

R. M. STEWART, Stock Clerk

COMMITTEES OF THE BOARD OF MANAGERS**EXECUTIVE COMMITTEE**

| | |
|-------------------------|---------------------|
| E. H. SANBORN, Chairman | ARTHUR W. GOODSPEED |
| G. H. BENZON, JR. | J. T. WALLIS |
| WALTON FORSTALL | |

COMMITTEE ON ENDOWMENT

| | |
|------------------------|-----------------------|
| G. H. CLAMER, Chairman | GEORGE D. ROSENGARTEN |
| BENJAMIN FRANKLIN | WM. CHATTIN WETHERILL |
| MARSHALL S. MORGAN | |

COMMITTEE ON FINANCE

| | |
|---------------------------|-----------------|
| WALTON FORSTALL, Chairman | JAMES S. ROGERS |
| BENJAMIN FRANKLIN | E. H. SANBORN |
| MARSHALL S. MORGAN | |

COMMITTEE ON MEMBERSHIP

| | |
|----------------------------|-----------------|
| ROBERT W. LESLEY, Chairman | CHARLES PENROSE |
| EDWARD G. BUDD | JAMES S. ROGERS |
| CLARENCE A. HALL | |

COMMITTEE ON PUBLICATIONS

| | |
|-------------------------|-----------------------|
| E. H. SANBORN, Chairman | GEORGE A. HOADLEY |
| JAMES BARNES | WM. CHATTIN WETHERILL |
| CHARLES E. BONINE | |

Editorial Staff of the Journal

| | |
|---------------------------|----------------------------------|
| HOWARD McCLENAHAN, Editor | ALFRED RIGLING, Assistant Editor |
|---------------------------|----------------------------------|

Associate Editors

| | |
|--------------------|----------------|
| JOSEPH S. AMES | A. E. KENNELLY |
| WILDER D. BANCROFT | HENRY LEFFMANN |
| E. J. BERG | C. E. K. MEES |
| GEORGE K. BURGESS | RALPH MODJESKI |
| JOHN J. CARTY | R. B. MOORE |
| E. G. COKER | GEO. O. SQUIER |
| A. S. CUSHMAN | W. F. G. SWANN |
| ARTHUR L. DAY | D. W. TAYLOR |
| A. S. EVE | A. F. ZAHM |
| PAUL D. FOOTE | JOHN ZELENY |
| W. J. HUMPHREYS | |

BARTOL RESEARCH FOUNDATION COMMITTEE

| | |
|--------------------------|--------------------|
| C. C. TUTWILER, Chairman | NATHAN HAYWARD |
| E. P. ADAMS | MARSHALL S. MORGAN |
| JOSEPH S. AMES | CHARLES PENROSE |
| WALTON CLARK | C. R. RICHARDS |
| ARTHUR L. DAY | W. F. G. SWANN |

SPECIAL COMMITTEE ON ENDOWMENT AND BUILDING FUND

| | |
|------------------------------|-----------------------|
| WM. C. L. EGLIN, Chairman | HENRY HOWSON |
| HOWARD McCLENAHAN, Secretary | ROBERT W. LESLEY |
| EDWARD G. BUDD | E. H. SANBORN |
| WALTON CLARK | C. C. TUTWILER |
| WALTON FORSTALL | S. T. WAGNER |
| BENJAMIN FRANKLIN | WM. CHATTIN WETHERILL |

COMMITTEES OF THE INSTITUTE

COMMITTEE ON LIBRARY

| | |
|-------------------------------|-------------------|
| GEORGE F. STRADLING, Chairman | CLARENCE A. HALL |
| C. W. BATES | JOSEPH S. HEPBURN |
| CHARLES E. BONINE | GEORGE A. HOADLEY |
| H. J. M. CREIGHTON | LIONEL F. LEVY |
| W. H. FULWEILER | M. M. PRICE |

COMMITTEE ON MEETINGS

| | |
|-----------------------------|-----------------------|
| HOWARD McCLENAHAN, Chairman | CHARLES PENROSE |
| JAMES BARNES | GEO. D. ROSENGARTEN |
| GEORGE S. CRAMPTON | COLEMAN SELLERS, 3RD |
| ARTHUR W. GOODSPEED | W. F. G. SWANN |
| G. A. HOADLEY | WM. CHATTIN WETHERILL |

COMMITTEE ON MUSEUM

| | |
|------------------------|---------------------|
| HUGO BILGRAM, Chairman | JOHN J. L. HOUSTON |
| G. H. BENZON, JR. | HENRY LEFFMANN |
| ARTHUR L. CHURCH | H. H. QUIMBY |
| THEOBALD F. CLARK | WILLIAM O. SAWTELLE |
| GEORGE A. HOADLEY | W. C. WAGNER |

FRANKLIN FUND AND BUILDING COMMITTEE

| | |
|------------------------|-------------------|
| HENRY HOWSON, Chairman | BENJAMIN FRANKLIN |
| WALTON CLARK | |

COMMITTEE ON SCIENCE AND THE ARTS

| | |
|-----------------------|---------------------|
| M. M. PRICE, Chairman | GEORGE S. CRAMPTON |
| N. W. AKIMOFF | H. J. M. CREIGHTON |
| HENRY B. ALLEN | GEORGE S. CULLEN |
| JAMES BARNES | SAMUEL B. ECKERT |
| CLIFFORD W. BATES | WM. C. L. EGLIN |
| GEORGE H. BENZON, JR. | WILLIAM G. ELLIS |
| HUGO BILGRAM | OWEN B. EVANS |
| CHARLES E. BONINE | J. LOGAN FITTS |
| WILLIAM L. BROWN, 3RD | BENJAMIN FRANKLIN |
| HAROLD CALVERT | W. H. FULWEILER |
| G. H. CLAMER | CHARLES D. GALLOWAY |
| EDWARD L. CLARK | CLARENCE A. HALL |
| THEOBALD F. CLARK | NATHAN HAYWARD |
| THOMAS D. COPE | |

COMMITTEE ON SCIENCE AND THE ARTS—(Continued)

| | |
|-----------------------|------------------------|
| JOSEPH S. HEPBURN | J. M. RUSBY |
| FREDERIC V. HETZEL | WILLIAM OTIS SAWTELLE |
| GEORGE A. HOADLEY | COLEMAN SELLERS, 3RD |
| W. N. JENNINGS | EDWARD W. SMITH |
| WILLIAM H. KAVANAUGH | JOHN C. TRAUTWINE, 3RD |
| JAMES D. LEE, JR. | C. C. TUTWILER |
| LIONEL F. LEVY | JAMES G. VAIL |
| K. G. MACKENZIE | JOHN A. VOGLESON |
| CHAS. H. MASLAND, 2ND | FRANCIS R. WADLEIGH |
| STEPHEN H. NOYES | WALTER C. WAGNER |
| FREDERIC PALMER, JR. | JOHN M. WEISS |
| CHARLES PENROSE | HOWARD W. WELLES |
| H. H. QUIMBY | WM. CHATTIN WETHERILL |
| FRANK H. ROGERS | ROBERT L. WOOD |
| JAMES S. ROGERS | WINTHROP R. WRIGHT |
| L. F. RONDINELLA | |

Standing Sub-committees**The Franklin Medal**

| | |
|------------------------|--------------------|
| JAMES BARNES, Chairman | H. J. M. CREIGHTON |
| CHARLES E. BONINE | BENJAMIN FRANKLIN |
| G. H. CLAMER | |

Literature

| | |
|-----------------------------|--------------------|
| BENJAMIN FRANKLIN, Chairman | H. J. M. CREIGHTON |
| CHARLES E. BONINE | LIONEL F. LEVY |
| THOMAS D. COPE | J. M. RUSBY |

New Subjects and Preliminary Examination

| | |
|------------------------------|------------------|
| H. J. M. CREIGHTON, Chairman | CLARENCE A. HALL |
| JAMES BARNES | NATHAN HAYWARD |
| CHARLES E. BONINE | LIONEL F. LEVY |
| GEORGE S. CRAMPTON | JAMES S. ROGERS |
| BENJAMIN FRANKLIN | JOHN M. RUSBY |

Trustees of the Elliott Cresson Medal Fund

| | |
|--------------|---------------|
| HENRY HOWSON | E. H. SANBORN |
|--------------|---------------|

PAST OFFICERS

1824-1927

PRESIDENTS

| | |
|--------------------------------|-------------------------------|
| BANES, CHARLES H., 1886 | ROGERS, ROBERT E., 1875-1878 |
| BIRKINBINE, JOHN, 1897-1906 | RONALDSON, JAMES, 1824-1841 |
| CLARK, WALTON, 1907-1923 | SELLERS, COLEMAN, 1870-1874 |
| CRESSON, JOHN C., 1855-1863 | SELLERS, WILLIAM, 1864-1866 |
| EGLIN, WM. C. L., 1924- | TATHAM, WILLIAM P., 1879-1885 |
| MERRICK, J. VAUGHAN, 1867-1869 | WILSON, JOSEPH M., 1887-1896 |
| MERRICK, SAMUEL V., 1842-1854 | |

VICE-PRESIDENTS

| | |
|--|--------------------------------------|
| AGNEW, JOHN, 1851, 1855-1863 | HEYL, HENRY R., 1895-1897 |
| ALLEMAN, GELLERT, 1924-1925 | HOWSON, HENRY, 1904- |
| BALDWIN, MATTHIAS W., 1855-1863 | JONES, WASHINGTON, 1900-1910 |
| BECK, PAUL, JR., 1826-1827 | LEVY, LOUIS E., 1916-1919 |
| BULLOCK, CHARLES, 1879-1900 | LONGSTRETH, EDWARD, 1890-1894 |
| CAREY, MATTHEW, 1824-1828 | LUKENS, ISAIAH, 1824-1825, 1829-1846 |
| CARTWRIGHT, HENRY, 1880-1881 | MILLER, ABRAHAM, 1847-1854 |
| CHRISTIE, JAMES, 1911 | MITCHELL, J. E., 1875-1887 |
| CLOSE, CHARLES S., 1875-1879 | MOORE, BLOOMFIELD H., 1869-1876 |
| CRESSON, GEORGE V., 1898-1903 | MORRIS, HENRY G., 1870-1879 |
| DAY, CHARLES, 1920-1923 | RAND, THEODORE D., 1897-1903 |
| DODGE, JAMES MAPES, 1903-1915 | ROGERS, FAIRMAN, 1864-1866 |
| EGLIN, WM. C. L., 1922-1923 | ROGERS, ROBERT E., 1868-1874 |
| EREBY, GEORGE, 1867 | SELLERS, COLEMAN, 1867-1869 |
| FLETCHER, THOMAS, 1828-1850, 1852-1854 | SELLERS, COLEMAN, JR., 1912-1922 |
| FORSTALL, WALTON, 1926- | TATHAM, WILLIAM P., 1888-1897 |
| FRAZER, JOHN F., 1865-1866 | TOWNE, JOHN H., 1864-1868 |
| GRAFF, FREDERICK, 1882-1890 | TUTWILER, C. C., 1924- |

RECORDING SECRETARIES

| | |
|--------------------------------------|--------------------------------|
| BULKLEY, JAMES H., 1831-1832 | PEROT, WILLIAM S., 1833-1834 |
| GARRIGUES, ISAAC B., 1830, 1837-1863 | ROBERTS, ALGERNON S., 1829 |
| JONES, THOMAS P., 1827-1828 | STRICKLAND, WILLIAM, 1824-1826 |
| JONES, WASHINGTON, 1864 | TRAUTWINE, JOHN C., 1835-1836 |

CORRESPONDING SECRETARIES

| | |
|--------------------------------|--------------------------------|
| BACHE, ALEX. DALLAS, 1840-1844 | FRALEY, FREDERICK, 1855-1863 |
| BRIGGS, ROBERT, 1864 | FRAZER, JOHN F., 1845-1847 |
| BROWNE, PETER A., 1824-1827 | HAYS, ISAAC, 1828-1839 |
| CRESSON, JOHN C., 1854 | ROBERTS, SOLOMON W., 1848-1853 |

SECRETARIES

| | |
|---|--|
| CHRISTIE, JAMES, 1909 | MORTON, HENRY, 1865-1870 |
| HOADLEY, GEORGE A. (Acting), 1917-1918, 1924-1925 | NORRIS, ISAAC, 1879-1881 |
| KNIGHT, J. B., 1875-1879 | OWENS, ROBERT B., 1910-1924 |
| McCLENAHAN, HOWARD, 1925- | WAHL, WILLIAM H., 1871-1874, 1882-1908 |

TREASURERS

| | |
|---|-------------------------------|
| BORGNER, CYRUS, 1908-1920 | MERRICK, SAMUEL V., 1828-1829 |
| FLETCHER, THOMAS, 1824-1825 | RICHARDSON, JOHN, 1826-1827 |
| FRALEY, FREDERICK, 1830-1847, 1865-1882 | SARTAIN, SAMUEL, 1883-1906 |
| FRANKLIN, BENJAMIN, 1920- | TREGO, CHARLES B., 1847 |
| FRAZER, JOHN F., 1848-1864 | WAHL, WILLIAM H., 1907 |

ACTUARIES

| | |
|--|----------------------------------|
| CHRISTIE, JAMES, Feb. 21-June 11, 1908 | JESTER, SIMEON VAN T., 1916-1918 |
| HAMILTON, WILLIAM, 1828-1871 | LARZELERE, JAMES S., 1908-1916 |
| HEYL, HERBERT L., 1885-1908 | PARRISH, T. R., 1922-1924 |
| HOLMAN, DAVID S., 1872-1885 | ROBINSON, LOUIS C., 1918-1922 |
| JACKSON, WILLIAM F., JR., 1924-1925 | WAHL, WILLIAM H., 1872 |

LIBRARIANS

| | |
|--------------------------------|------------------------|
| HILTEBRAND, EMANUAL, 1874-1887 | RIGLING, ALFRED, 1887- |
|--------------------------------|------------------------|

CONTROLLERS

| |
|---------------------------------|
| JACKSON, WILLIAM F., JR., 1925- |
|---------------------------------|

MANAGERS

| | |
|-----------------------------------|---|
| ABBOT, WILLIAM, 1824-1826 | ARCHER, ELLIS S., 1858-1859 |
| ADAMSON, WILLIAM, 1864 | BACHE, ALEX. DALLAS, 1830-1839 |
| ADDICKS, JOHN E., 1845-1850 | BALCH, EDWIN S., 1902-1912 |
| AGNEW, JOHN, 1831-1850, 1852-1854 | BALDWIN, MATTHIAS W., 1827-1854 |
| ALLEMAN, GELLERT, 1918-1923 | BANES, CHARLES H., 1877-1885, 1887-1895 |
| ALLEN, JAMES, 1845 | BARKER, GEORGE F., 1874-1875 |
| ALLISON, WILLIAM C., 1863 | |

MANAGERS—(Continued)

- BARNES, JAMES, 1925-
 BARRAS, JOSEPH J., 1851-1860
 BARTOL, BARNABAS H., 1863-1865
 BARTOL, HENRY W., 1870-1878
 BAUGH, DANIEL, 1900-1902
 BAUGH, HARMAN, 1855
 BEALE, JOSEPH, 1827
 BEARDSLEY, ARTHUR, 1894-1902
 BECK, PAUL, JR., 1824-1825
 BEMENT, CLARENCE S., 1871
 BEMENT, WILLIAM B., 1866-1870
 BENZON, GEORGE H., JR., 1925-
 BERGNER, THEODORE, 1870-1875
 BETTS, WILLIAM C., 1844
 BIDDLE, CLEMENT C., 1824
 BILGRAM, HUGO, 1885-1890
 BIRKBECK, JOHN, 1869-1871
 BIRKINBINE, HENRY P. M., 1851-1856
 BIRKINBINE, JOHN, 1907-1915
 BOLTON, JAMES M., 1830
 BONINE, CHARLES E., 1921-
 BORGNER, CYRUS, 1903-1907
 BOSWELL, WILLIAM L., 1896-1898
 BOWER, HENRY, 1891-1896
 BRIGGS, ROBERT, 1867-1873
 BROCK, ROBERT C. H., 1901-1906
 BROLASKY, HENRY C., 1897-1902
 BRYSON, JAMES H., 1857-1863
 BUDD, EDWARD G., 1927-
 BULKLEY, JAMES H., 1830, 1833-1841
 BULLOCK, CHARLES, 1868-1878
 BURNHAM, GEORGE, 1878
 BURTIS, AARON H., 1845
 CARR, WILLIAM H., 1837-1845
 CARTWRIGHT, HENRY, 1865-1879
 CHABOT, CYPRIEN, 1877-1889
 CHAMBERS, CYRUS, JR., 1876-1890
 CHAMBERS, FRANCIS T., 1913-
 CHASE, PLINY E., 1864-1886
 CHESTERMAN, FRANCIS J., 1926
 CHRISTIE, JAMES, 1897-1908
 CLAMER, G. H., 1917-
 CLARK, THEOBALD F., 1917-
 CLARK, WALTON, 1903-1906, 1924-
 CLARKE, JAMES, 1824-1826
 CLOSE, CHARLES S., 1865-1874
 CLOUD, JOSEPH, 1824
 CODMAN, JOHN E., 1892-1894
 COLLINS, ISAAC, 1828
 CONARD, THOMAS P., 1894-1908
 CONARROE, GEORGE W., 1851-1863
 COOPER, JOHN H., 1870-1873
 COPPER, JOHN C., 1851
 CORNELIUS, ROBERT, 1855-1863
 CORNELIUS, ROBERT C., 1866-1868
 CRAMP, CHARLES H., 1864-1867, 1875,
 1895-1897
 CRESSON, GEORGE V., 1886-1897
 CRESSON, JOHN C., 1835-1853
 CRESSON, WILLIAM P., 1848-1849
 DARRACH, CHARLES G., 1894-1896
 DAY, CHARLES, 1908-1919, 1924-
 DIVINE, WILLIAM, 1864
 DODGE, JAMES MAPES, 1896-1903
 DODGE, KERN, 1916-1920
 DONALDSON, JOSEPH, 1825
 DOUGHERTY, JAMES, 1858-1861
 DRAPER, EDMUND, 1847-1850
 DREER, FERDINAND J., 1862
 DROWN, WILLIAM A., 1861-1863
 DU BOIS, WILLIAM L., 1880-1882
 DURFEE, WILLIAM F., 1872-1873
 EASTWICK, ANDREW M., 1836-1844
 EASTWICK, EDWARD P., 1859-1860
 EBERT, MORRIS, 1908-1911
 ECKERT, GEORGE M., 1852-1854
 EGLIN, WM. C. L., 1908-1922
 EISENHUT, JOHN D., 1824-1825

MANAGERS—(Continued)

- ELDRIDGE, G. MORGAN, 1885-1890
 ELLIS, JAMES P., 1848-1851
 EMERSON, G., 1828
 EREBY, GEORGE, 1854-1866
 EVANS, OWEN, 1844-1857
 FERGUSON, ALEXANDER, 1831-1841
 FLETCHER, THOMAS, 1826-1827
 FLING, WILLIAM B., 1842
 FORSTALL, WALTON, 1908-1925
 FOX, GEORGE, 1828-1830
 FRALEY, FREDERICK, 1829, 1848-1854
 FRANKLIN, BENJAMIN, 1917-1919
 FRAZER, JOHN F., 1844, 1865-1866
 FRAZER, PERSIFOR, 1880-1891, 1903-1909
 FRAZIER, GEORGE H., 1898
 FRENCH, HOWARD B., 1900
 FRY, WILLIAM, 1825
 GARDINER, JOHN, JR., 1864
 GARRIGUES, ISAAC B., 1825-1829, 1831-1836
 GARRISON, F. LYNWOOD, 1890-1895, 1897-1903
 GAWTHROP, HENRY, 1896-1898
 GIBBS, ALFRED W., 1915-1922
 GIBSON, J. HOWARD, 1893-1894
 GIBSON, JOHN J., 1912-1915
 GILDER, JOHN, 1838-1841
 GILPIN, THOMAS, 1824
 GOBRECHT, CHRISTIAN, 1828-1830
 GOLDSMITH, E., 1908-1916
 GOODSPEED, ARTHUR W., 1925-
 GRAFF, FREDERICK, 1852-1854, 1858-1865, 1880-1881
 GRAHAM, HOWARD S., 1920-1921
 GREBLE, EDWIN, 1841-1863
 GREENE, STEPHEN, 1898-1908
 GRIES, JOHN M., 1858-1862
 GRIFFITH, R. EGGLESFIELD, 1870-1871
 GRIFFITH, ROBERT E., 1827
 GROVES, DANIEL, 1824-1827
 HALL, CLARENCE A., 1922-
 HAND, JAMES C., 1845-1846
 HANSELL, WILLIAM S., 1827
 HARDING, GEORGE, 1864-1865
 HARKER, JOSHUA G., 1831-1836
 HARPER, JAMES, 1824-1826
 HARRIS, WILLIAM, 1860-1863
 HARRISON, ALFRED C., 1895-
 HARRISON, C. LELAND, 1899-1902
 HARRISON, JOHN, 1824-1829
 HARRISON, JOSEPH, JR., 1854, 1856-1859
 HART, SAMUEL, 1865-1870
 HAVILAND, JOHN, 1824-1826
 HAYS, ISAAC, 1840-1841
 HAYWARD, NATHAN, 1917-
 HELLER, CHARLES S., 1879-1880
 HELME, WILLIAM, 1869-1888
 HENDERSON, GEORGE R., 1915-1921
 HERSE, GEORGE P., 1851
 HEXAMER, CHARLES A., 1904-1925
 HEYL, HENRY R., 1879-1895, 1898-1909
 HOADLEY, GEORGE A., 1911-
 HORN, HENRY, 1824
 HORSTMANN, WILLIAM J., 1865-1868
 HOUSTON, EDWIN J., 1874-1897
 HOWARD, GEORGE C., 1855-1858
 HOWE, HERBERT M., 1898-1900
 HOWSON, CHARLES HENRY, 1903-1907
 HOWSON, HENRY, 1898-1903
 HUFTY, SAMUEL, 1834-1850
 HUMPHREYS, SAMUEL, 1826
 HUNTER, JAMES, 1864
 HUTCHINSON, CHARLES H., 1888-1890
 HUTCHINSON, JAMES, 1841-1842
 HUTCHINSON, JOSEPH, 1860-1863
 JAYNE, HARRY W., 1891-1910

MANAGERS—(Continued)

- JENNINGS, W. N., 1896
 JOHNSON, LAWRENCE, 1855-1859
 JONES, THOMAS P., 1826
 JONES, WASHINGTON, 1859-1895, 1897-1900
 KATEZ, I., 1824
 KEATING, WILLIAM H., 1824-1826, 1830-1840
 KELLER, HARRY F., 1914-1924
 KELLY, HENRY H., 1851
 KING, ROBERT P., 1851
 KIRK, CHARLES H., 1830
 KIRKPATRICK, GEORGE E., 1911-1914
 KLUMPP, JOHN BARTLEMAN, 1923
 KNEASS, WILLIAM, 1825
 KNIGHT, DANIEL R., 1845
 KRUMBHAAR, ALEXANDER, 1898-1911
 KUHN, C. HARTMAN, 1896-1905
 LAMBERT, WM. H., 1906
 LESLEY, ROBERT W., 1913-
 LE VAN, W. BARNET, 1864-1876
 LEVY, LOUIS E., 1903-1915
 LEWIS, ENOCH, 1868-1894
 LEWIS, HARVEY, 1824-1827
 LEWIS, MORDECAI D., 1828-1836
 LINDSAY, JOHN, 1843
 LINDSAY, ROBERT, 1834-1836
 LINNARD, JAMES M., 1836-1838
 LINVILLE, J. HAYES, 1868
 LONGSTRETH, CHARLES, 1903-1907
 LONGSTRETH, EDWARD, 1868-1870, 1895-1897
 LOUD, THOMAS, 1829-1831
 LOVE, WILLIAM H., 1859
 LUCAS, JOHN, 1888-1894
 LUKENS, ISAAH, 1828
 LUKENS, JAWOOD, 1902-1908
 LYMAN, BENJAMIN S., 1901-1902
 McALPINE, JAMES, 1825-1828
 McCAFFREY, E. V., 1910-1924
 MCCAMBRIDGE, RICHARD, 1876
 McCCLURE, JOHN, 1853-1856
 McCCLURG, ALEXANDER, 1833-1839
 McEUEEN, THOMAS, 1829
 McKEAN, WILLIAM V., 1879-1883
 MARKS, WILLIAM D., 1881-1884
 MARSHALL, SAMUEL R., 1887-1893
 MASON, DAVID H., 1824
 MASON, JAMES S., 1861
 MEGARGEE, CHARLES, 1858
 MEIRS, RICHARD WALN, 1908-1917
 MERRICK, J. VAUGHAN, 1864-1866, 1870-1884
 MERRICK, SAMUEL V., 1824-1827, 1830-1841, 1855-1863
 MIFFLIN, LLOYD, 1825-1826
 MILES, FREDERICK B., 1874
 MILLER, ABRAHAM, 1824-1846, 1855-1858
 MITCHELL, J. E., 1874
 MITCHELL, WILLIAM A., 1864-1865
 MOORE, BLOOMFIELD H., 1864-1868
 MOORE, JOSEPH W., 1860-1861
 MORGAN, MARSHALL S., 1914-
 MORRIS, ELWOOD, 1844-1847
 MORRIS, HENRY G., 1864-1869
 MORRIS, ISAAC P., 1836-1843
 MORRIS, WILLIAM E., 1847-1851
 MUCKLE, M. RICHARDS, JR., 1894-1896
 NAYLOR, JACOB, 1863, 1865-1872
 NEAFIE, JACOB G., 1868
 NEWHALL, PAUL W., 1843-1844
 NORRIS, ISAAC, 1870-1878, 1883-1918
 NYSTROM, JOHN W., 1873-1875
 OGDEN, JOHN M., 1833
 OGLE, WILLIAMS, 1845-1850
 O'NEILL, JOHN, 1827-1832
 ORR, HECTOR, 1871-1887

MANAGERS—(Continued)

- OUTERBRIDGE, ALEX. E., JR., 1881-1886
 PALMER, B. FRANKLIN, 1862
 PARRISH, WILLIAM D., 1838, 1852-1854
 PARRY, CHARLES T., 1864
 PATTERSON, ROBERT, 1824
 PATTERSON, ROBERT M., 1825-1827
 PAUL, LAWRENCE T., 1895-1926
 PEMBERTON, HENRY, JR., 1891-1896
 PENROSE, CHARLES, 1925-
 PERRY, ROBERT S., 1912-1916
 PETTIT, HORACE, 1894-1910
 PURVES, ALEXANDER, 1875-1876
 RALSTON, ASHBEL G., 1825-1830
 RAMAGE, ADAM, 1824-1832
 RAND, THEODORE D., 1874-1897
 REED, WILLIAM B., 1832-1836
 REEVES, BENJAMIN, 1829-1837
 REEVES, SAMUEL J., 1864
 REEVES, STACY, 1889-1902
 RICE, JOHN, 1866-1867
 RICHARDS, MARK, 1831
 RICHARDSON, JOHN, 1825
 RIEHLE, HENRY J., 1826-1827
 ROBBINS, SAMUEL J., 1827-1833
 ROBERTS, ALGERNON S., 1828
 ROBERTS, PERCIVAL, 1864-1868
 ROBERTS, SOLOMON W., 1842-1847
 ROBINSON, ALEXANDER P., 1911-1916
 ROGERS, EVANS, 1854-1863
 ROGERS, HENRY D., 1838-1843
 ROGERS, JAMES S., 1909-
 ROGERS, ROBERT E., 1867
 RONALDSON, CHARLES E., 1885-1893, 1908-1912
 ROSENGARTEN, GEORGE D., 1912-
 ROWLAND, JAMES, JR., 1829-1830
 ROWLAND, WILLIAM, 1828
 RUSH, WILLIAM, 1825
 RUST, JAMES I., 1824
 SADTLER, SAMUEL P., 1888-1897
 SANBORN, E. H., 1907-
 SARTAIN, JOHN, 1877-1879
 SARTAIN, SAMUEL, 1865-1882
 SAVERY, PELEG B., 1851-1852
 SAXTON, JOSEPH, 1842-1844
 SAY, BENJAMIN, 1832-1833
 SCATTERGOOD, THOMAS, 1829-1834
 SCHAUM, OTTO W., 1907
 SCHREINER, JOSEPH H., 1827-1832
 SCHUMANN, FRANCIS, 1899-1902
 SEIPER, THOMAS, 1824
 SELLERS, COLEMAN, 1862-1866, 1875-1905
 SELLERS, COLEMAN, JR., 1906-1911
 SELLERS, WILLIAM, 1857-1861, 1867-1892
 SHAIN, CHARLES J., 1884-1887
 SHINN, EARLE, 1836-1837
 SLOAN, SAMUEL, 1864
 SMITH, CHARLES E., 1852-1855
 SMITH, HASELTINE, 1922-
 SOUDER, JACOB, 1828
 SPANGLER, HENRY W., 1891-1893
 STEVENSON, WILLIAM, JR., 1828
 STEWART, THOMAS S., 1842-1850, 1852-1863
 STRICKLAND, WILLIAM, 1828
 STRUTHERS, JOHN, 1827-1849
 TABER, GEORGE, 1839-1842
 TATHAM, WILLIAM P., 1870-1878, 1886-1887
 THOMPSON, AMBROSE W., 1839-1843
 THOMSON, ELIHU, 1878-1881
 THORNE, WILLIAM H., 1881-1897
 THORNLEY, JOHN, 1851
 TILGHMAN, BENJ. C., 1871-1875
 TOPPAN, CHARLES, 1831-1832

MANAGERS—(Continued)

- TOWNE, JOHN H., 1840-1857, 1869
TOWNSEND, EDWARD Y., 1866-1867
TRACY, ELIASHIB, 1851
TRAUTWINE, JOHN C., 1834, 1844,
1852-1857
TRAUTWINE, JOHN C., JR., 1891-1895
TREGO, CHARLES B., 1837-1846
TREVOR, JOHN B., 1832
TROTH, HENRY, 1837-1841
TRYSON, GEORGE W., 1831-1833
TUTWILER, C. C., 1920-1923
TYLER, RUFUS, 1826-1837
VAUCLAIN, SAMUEL M., 1898, 1906
VAUX, GEORGE, JR., 1898-1899
WAGNER, SAMUEL T., 1927-
WALLIS, J. T., 1923-
WALTER, JOSEPH S., JR., 1834-1837
WALTER, THOMAS U., 1829-1831,
1840-1851
WARDER, WILLIAM S., 1825-1827
WARNER, JOHN S., 1837-1843
WEAVER, JACOB, 1856-1857
WEAVER, JOHN J., 1880-1891
WEIGHTMAN, WILLIAM, 1862-1863
WETHERILL, CHARLES, 1835
WETHERILL, J. P., 1902
WETHERILL, JOHN P., 1824-1825
WETHERILL, WILLIAM, 1832
WETHERILL, WILLIAM C., 1916-
WEYGANDT, THOMAS J., 1851-1863
WHARTON, WILLIAM, JR., 1871
WHITAKER, GEORGE P., 1851-1852
WHITE, CHARLES H., 1828-1835
WHITE, SAMUEL S., 1864-1867
WHITNEY, ASA, 1846-1850
WHITNEY, GEORGE, 1858-1860
WHITNEY, JAMES S., 1862-1863, 1865-
1869
WHITNEY, JOHN R., 1861
WICKHAM, M. T., 1824
WIEGAND, JOHN, 1831-1853
WIEGAND, S. LLOYD, 1864, 1890-1893
WILLIAMS, EDWARD H., 1871-1872
WILLIAMS, ISAAC S., 1846-1850, 1852-
1863
WILSON, JOSEPH M., 1869-1886
WILSON, O. HOWARD, 1864-1869
WOLBORN, CORNELIUS A., 1844-1850
WOLF, OTTO C., 1897-1913
WOOD, ALAN, 1845-1863
WOOD, SAMUEL R., 1824-1825
WOOD, WALTER, 1903-1912
WOOTTEN, JOHN E., 1860-1862
YARDLEY, WILLIAM, JR., 1829
YEAGER, JOSEPH, 1832
YOUNG, ANDREW, 1828-1830

PAST CHAIRMEN OF THE COMMITTEE ON SCIENCE AND THE ARTS, 1834-1927

| | |
|---|---|
| BACHE, ALEXANDER D., 1834-1836, 1839-1844 | HOADLEY, GEORGE A., 1911-1912 |
| BARNES, JAMES, 1922-1923 | KOENIG, G. A., 1888-1889 |
| BEARDSLEY, ARTHUR, 1892-1895 | LEVY, LOUIS E., 1901-1902 |
| BENZON, GEORGE H., JR., 1924-1925 | LEWIS, WILFRED, 1912-1913 |
| BILGRAM, HUGO, 1906-1907 | MARBURG, EDGAR, 1899-1900 |
| BONINE, CHARLES E., 1916-1917 | MARKS, W. D., 1881-1882, 1887-1888 |
| CALVERT, HAROLD, 1925-1926 | MASLAND, CHARLES W., 1921-1922 |
| CHRISTIE, JAMES, 1897-1898 | MCCONNELL, JACOB Y., 1909-1910 |
| CLAMER, G. H., 1915-1916 | ORR, HECTOR, 1880-1881 |
| CONARD, THOMAS P., 1902-1903 | PATTERSON, R. M., 1836-1839 |
| CREIGHTON, H. JERMAIN, 1918-1919 | PENROSE, CHARLES, 1920-1921 |
| CRESSON, J. C., 1844-1874 | PRICE, M. M., 1927- |
| CRISFIELD, J. A. P., 1913-1914 | ROGERS, JAMES S., 1908-1909 |
| ELDRIDGE, G. MORGAN, 1896-1897 | RONALDSON, CHARLES E., 1903-1904 |
| FRANKLIN, BENJAMIN, 1919-1920 | RONDINELLA, L. F., 1898-1899 |
| FULWEILER, W. H., 1923-1924 | SARTAIN, SAMUEL, 1895-1896 |
| GOLDSMITH, EDWARD, 1905-1906 | SELLERS, COLEMAN, 1875-1880 |
| GRIGGS, WILLIAM O., 1907-1908 | SPANGLER, H. W., 1890-1891 |
| HALL, CLARENCE A., 1926-1927 | SPENCER, THOMAS, 1910-1911 |
| HAUPT, LEWIS M., 1904-1905 | WETHERILL, WM. CHATTIN, 1917-1918 |
| HENDERSON, GEORGE R., 1914-1915 | WIEGAND, S. LLOYD, 1889-1890, 1891- 1892 |
| HEYL, HENRY R., 1882-1887, 1893- 1894, 1900-1901 | |

THE INSTITUTE'S ACTIVITIES

THE FRANKLIN INSTITUTE was organized in the year 1824 to meet a demand in America for an Institution similar to that founded by Count Rumford in London in 1799. The founders intended it not only as an appropriate memorial to the name of Franklin, but as a means of continuing for all time a work which throughout his long life he perhaps regarded as his best, namely, the discovery of physical and natural laws and their application to increase the well-being and comfort of mankind.

The Hall of the Institute is located on the east side of Seventh Street, between Market and Chestnut Streets, and was built from plans furnished by John Haviland, architect. The corner-stone was laid with appropriate Masonic and other ceremonies, on the eighth day of June, 1825, at noon. The funds for the purchase of the lot and the erection of the building were provided by the issue of a building loan, which was freely taken by members and friends of the enterprise, and has long since been repaid. The building was completed, and the Institute took possession of all except the second floor (which was occupied by the United States Courts until 1830) in 1826. Upon the first floor are located the lecture-room (capable of accommodating about 300), and laboratories and offices. The second floor is occupied by the library, to which special attention is paid elsewhere.

THE LIBRARY

The plan of the founders contemplated "the formation of a library of books relating to science and the useful arts, and the opening of a reading-room"; and, accordingly, in 1827, the first Committee on Library was appointed.

The books forming the nucleus of the library were stored in the residence of a member of the committee until early in the year 1829, when the first reading-room was opened. During the next year a special committee of twenty issued an appeal for books and contributions of money in aid of the library.

The founding of the JOURNAL, in 1826, by opening the way to the establishment of exchange relations with other societies and with the leading magazines and periodicals devoted to science and the useful arts, proved an invaluable help in promoting its growth, and thus, early, gave to the library the distinctive character which it has since maintained. From the nucleus formed by this useful agency has grown a reference library of scientific literature, in some branches unique, and, in extent and completeness, second to none in the United States, embracing the publications of the principal scientific and technical societies of the world, and the leading periodicals devoted to science and the arts.

Several of the foreign governments have deposited with the library complete sets of their patent office publications. There are on the shelves for reference files of the specifications of the patent office of Great Britain since the year 1617, of Switzerland since 1888, of the United States since 1790. The specifications of French patents 1791 to 1900 and abstracts of the patents

granted by Germany, Russia, Canada, Australia, Hungary and Austria can also be consulted.

The library is annually enriched, also, by the gift of numerous technical publications of a miscellaneous character from foreign governments, and from states and municipal authorities and corporations. These embrace publications relating to public works; official reports relating to geology, the mining and metallurgical industries, agriculture, public health, municipal engineering; reports of railway and other transportation companies, manufacturing corporations, etc.

For many years it has been the policy of this committee to increase the value of the collection as a library of reference, and to this end it has devoted systematic efforts to the task of completing the files of its important serial publications. In this work, the committee, with the substantial assistance of several liberal contributions of money from generous friends of the Institute, has been notably successful.

At the present time the collection consists of 85,200 volumes and 25,600 pamphlets.

To inventors and manufacturers seeking for information respecting the state of the arts and manufactures, the extensive collection of patent literature which the library places at their disposal is indispensable, and the library is constantly resorted to by attorneys and their clients for the purpose of consulting these volumes; while, to the professional man and the student, the scientific and technical serials in which the library is so rich are no less indispensable as an aid in pursuing the investigations.

The library is open daily from 9 o'clock A.M., until 5 o'clock P.M., Saturdays twelve o'clock noon. The Institute is closed on all state and national holidays.

THE COMMITTEE ON SCIENCE AND THE ARTS

A branch of the Institute's work, which, perhaps, more obviously than any other, illustrates the spirit which animated the founders, and which their successors have worthily perpetuated and striven to improve and extend, is that which is now conducted by the Committee on Science and the Arts.

One of the things that was, apparently, uppermost in the thoughts of the founders, was the need—as urgent then as to-day—felt by inventors and discoverers, of some competent, trustworthy and impartial body, to whom they could safely appeal for advice, and on whose judgment they could confidently rely for an opinion as to the usefulness of their inventions and discoveries.

One of the first acts of the Board of Managers was to appoint a Board of Examiners, whose duty it was to examine and make report upon all new and useful machines, inventions and discoveries submitted to them. Subsequently the name of the Board of Examiners was changed to the "Committee on Inventions."

This organization continued in existence until the year 1834, when, by act of the Institute, it was abolished, and in its place there was established the "Committee on Science and the Arts," with enlarged powers and a wider field of labor. As originally constituted, membership in this committee was open to all members of the Institute in good standing who chose to enroll their names, and who by thus voluntarily associating themselves with the committee, pledged themselves to perform the duties assigned to them.

Under this form of organization the committee continued for more than fifty years, and its usefulness during this long period is attested by its records, containing the results of the examination of a great number of inventions, and of its investigations of many subjects of importance entrusted to it by the Institute.

In the year 1886, the Institute adopted an amendment to its by-laws, by which this committee was reorganized on an elective basis, thus abolishing the plan of voluntary association which had heretofore been a distinguishing feature. By this amendment the Institute established a Committee on Science and the Arts, to be composed of forty-five members of the Institute, to be chosen at the annual election (fifteen each year), and "who shall pledge themselves by their acceptance of membership to perform such duties as may devolve upon them, and to sustain by their labors the scientific character of the Institute."

Some years later the membership of the committee was increased from forty-five to sixty and by a provision recently adopted the members are elected by the Board of Managers, twenty each year.

During the past twenty-five years the committee has investigated nearly 1000 discoveries, processes, and inventions.

THE JOURNAL

The publication of a journal for the diffusion of knowledge on all subjects connected with science and the useful arts, was embraced in the plan of the founders, and was undertaken shortly after the organization had been effected. This publication has been continued without interruption to the present time, and has proved most useful, not only in directly promoting the aims and objects of the Institute, but also in extending the sphere of its influence beyond the limits of its local habitation.

The first step to secure a publication was taken by the Institute as early as 1825, when, by arrangement with C. S. Williams, publisher, a magazine bearing the title *The American Mechanics' Magazine*, and which had been founded by him in New York at the beginning of that year, was acquired by Dr. Thomas P. Jones, who had recently been elected professor of mechanics in The Franklin Institute. At the outset the responsibility of this venture appears to have been assumed by Doctor Jones, after he had received assurances of active coöperation and support from the members of the Institute, who were warmly interested in its success.

The prospectus of the new publication, which was issued August 1, 1825, announced the fact that "shortly will be published

THE
FRANKLIN JOURNAL
AND
MECHANICS' MAGAZINE,
UNDER THE PATRONAGE OF

THE FRANKLIN INSTITUTE, OF THE STATE OF PENNSYLVANIA, FOR THE PROMOTION OF THE
MECHANIC ARTS, EDITED BY DR. THOMAS P. JONES, PROFESSOR OF
MECHANICS IN THE INSTITUTE."

The object of *The Franklin Journal*, as defined in the prospectus, was, "to diffuse information on every subject connected with useful arts."

In the prospectus of *The Franklin Journal* attention is called to the fact that it was intended to give a list of patented inventions, with remarks upon their utility and originality. This proposition was literally maintained and continued as a prominent feature of the JOURNAL to the close of 1859, save that the "Remarks," which were in many cases of the greatest value to those interested in the progress of the arts and manufactures, were discontinued on the death of Doctor Jones. His accession to the position of Superintendent of the Patent Office naturally caused him to devote special attention to the preservation of the record of patents in the pages of the JOURNAL. This circumstance has since proved of considerable value to all who have need to refer to the early patents of the United States, as will appear from the following explanation:

In the official Patent Office publications, issued by the Government prior to the year 1843, the publication of the claims was omitted; while, for a considerable period, the JOURNAL published an abstract of the specifications and the claims in full. The JOURNAL, consequently, is the only source at present available for reference to the specifications and claims of patents issued by the United States from 1828 to 1842, inclusive. The JOURNAL can also be used, in place of the official publications, as a source of reference to the patents granted during the period 1826-1859 in which the patent lists were published therein.

The complete file of the JOURNAL embraces *The Franklin Journal*, 1826-1827, and the JOURNAL OF THE FRANKLIN INSTITUTE, 1828 to the present time, 203 volumes in all, with a General Index, 1826 to 1885, and three decennial volumes covering the years 1886 to 1915, inclusive. The fourth decennial index 1916-1925, is in preparation and will be published shortly.

In its present form, the JOURNAL is an octavo of about 150 pages. It is published monthly, the twelve impressions being divided into two volumes yearly—January to June and July to December, each separately paged, and supplied with title-page and index.

INSTRUCTION

The first Board of Managers of the Institute provided for the establishment of a standing Committee on Instruction, charged with the duty of directing its educational work.

This committee was appointed on March 4, 1824, and speedily perfected plans for systematic instruction by means of lectures and demonstrations. Professorships in chemistry, in natural philosophy and mechanics, and in architecture were established and filled by the election of capable instructors.

Provision was next made for the instruction of mechanics and apprentices and those engaged in the useful trades, and early in the fall of 1824 a school of mechanical and architectural drawing was established. This experiment seems to have been crowned with complete success; and the managers proceeded to establish another school, in which should be taught "all the useful branches of English literature and the ancient and modern languages." This project was realized in 1826. In 1827 over three hundred scholars were upon its roll. It was the model upon which the Central High School, shortly afterwards established by the city as part of the public school system, was patterned.

The drawing school was continued, and maintained an uninterrupted existence for ninety-nine years. Its leading feature—that of training pupils for actual work in shop and office—was always rigorously preserved.

Twenty-nine years ago classes in mathematics were established; these later became a part of the school of machine design. Instruction in naval architecture was first given in October, 1899.

All departments of instruction were united in the year 1910 and known as the School of Mechanic Arts.

For a period of ninety-nine years the Institute afforded educational training of a high order to many thousands of young men who, judging by many notable successes, benefited greatly by such training. The educational function of the Federal Government, State and City having been extended to cover fully the Institute's field of effort in vocational training, the work of its school has been suspended.

LECTURES

These have always occupied a prominent place in the scheme of the Institute's work, from the beginning to the present.

The first course was given in the old Academy Building, on Fourth Street, near Arch, owned by the University of Pennsylvania, the use of which for this purpose was granted by the trustees; and the work of the professors was ably supplemented by a corps of volunteer lecturers from the membership of the Institute. A little later, the Institute rented the lower floor of the old Carpenters' Hall for this purpose, and finally, on the completion and occupancy of the hall, the lectures were held in its own lecture room.

For many years the lectures were of the nature of regular courses on architecture, mechanics, physics, and chemistry, varied of course from year to year, but following generally the plan of graded or consecutive instruction, as in schools and colleges. This system, however, though for a long period admirably useful in meeting the needs of the public, was found in time to be gradually outgrowing its usefulness. Lecture courses on scientific themes, which for years had been practically preëempted by The Franklin Institute, in time were made attractive features in the schools and colleges, and the popular science lecturer became a conspicuous figure on the public lecture platform. And so it came about, naturally, that the Committee on Instruction found it advantageous gradually to modify its plans to adapt them to the changes of the times. For a number of years, accordingly, the character of the Institute lectures has departed widely from the old-time pattern. The object at present most conspicuously kept in view in the selection of the lectures is to give the members of the Institute the advantage of having presented to them the latest advances in the useful arts and the sciences bearing thereon; and, to this end, the committee's efforts each year are directed to the purpose of securing the services of men of eminence in their respective fields of labor, who are invited to select their own themes. Since its foundation, The Franklin Institute, has given free to the public thousands of lectures by distinguished scientists and technologists on scientific and technological subjects in addition to numerous popular and illustrated addresses on subjects of immediate interest to the public and germane to the topics of the day.

THE JAMES MAPES DODGE LECTURE FOUNDATION

The James Mapes Dodge Lecture Foundation was established by Mrs. James Mapes Dodge as a memorial to her late husband, who was for a long time a member of the Institute, and for fifteen years a Vice-President. The Foundation permits the Institute to maintain the Christmas Week Lectures for young people which were inaugurated in December, 1926. These lectures are of a quality suited for young people of high school or preparatory school age. They are to be delivered by scientists of distinguished accomplishments, and are expected to arouse in their hearers a lasting interest in physical science.

MEETINGS

General meetings of the Institute's entire membership are held once each month, except during the summer. At these meetings great inventions and discoveries, important engineering projects, and notable achievements in all fields of scientific progress are presented, exhibited or discussed. Many of the epoch-making inventions have been shown in their experimental stages at these meetings—as the phonograph, the electric light, the typewriter, liquid air apparatus, machine telegraphy, etc.

EXHIBITIONS

As a means of promoting the mechanic arts, the holding of exhibitions was highly favored by the founders, and in this field of activity the Institute, for many years, was conspicuously prominent.

The first exhibition of American manufactures was held in October, 1824, in Carpenters' Hall.

This, it should be remembered to the credit of the Institute, was the first of the kind to be undertaken in this country.

The exhibitions of the Institute were held yearly or biennially, down to the year 1858. Many of the earlier events took place in the old Masonic Hall, on Chestnut Street, above Seventh, and in a temporary annex thereto; and the more recent ones in the one-time famous Museum Building, at Ninth and Sansom Streets, the destruction of which by fire, in the year 1850, made it necessary for the managers, for several years, to adapt themselves to less desirable quarters, and finally to discontinue the exhibitions for a time for want of a centrally located building suitable for the purpose.

In the year 1874 occurred the fiftieth anniversary of The Franklin Institute, and a fortunate circumstance enabled the managers to signalize the event by holding an exhibition, which proved from every point of view an eminently successful one. The circumstance spoken of was the fact that the Pennsylvania Railroad Company placed at the service of the Institute, for exhibition purposes, the old building at Thirteenth and Market Streets, for many years occupied as a freight station. Over 268,000 visitors attended this exhibition.

Successful, however, as was the exhibition of 1874, it was eclipsed in brilliancy, and in value from the educational and technical standpoint, by that of 1884, which will ever be memorable in the annals of The Franklin Institute. This was the Electrical Exhibition, held in the autumn of that year, under the direction of the Institute, and which by Act of Congress, approved February 26, 1883, was made international in character. It was the first exhibition in America devoted exclusively to the electrical arts.

In 1885 the Novelties Exhibition was held in the building erected for the electrical exhibition.

No further exhibitions have been held since that time, though the Institute coöperated with the Commercial Museum of Philadelphia in the management of the National Export Exposition of 1899.

MODELS AND HISTORICAL APPARATUS

This collection includes the electrical machine used by Doctor Franklin in his experiments in Philadelphia, his imposing stone and table for dressing type; Doctor Priestley's air pump, brought by him to America in 1794; odometer used by Doctor Franklin when postmaster-general of the colonies and by Thomas Jefferson; George M. Phelps' printing telegraph apparatus; magneto-electric machine made by Joseph Saxton and exhibited by him at the meeting of the British Association for the Advancement of Science in 1833; Oertling balance made about 1840; model of Oliver Evans' first high-pressure steam engine, made by Rush and Muhlenberg; model of George Stephenson's "No. 1" locomotive built for the Stockton and Darlington Railroad.

There are also numerous examples of metering devices for water, air, gas and electricity; photographic apparatus; typing and calculating machines and philosophical apparatus, the whole illustrative of the genius for discovery and invention that have made the past century notable in the history of science and its application in the industries.

In January, 1927, The Franklin Institute received from the Royal Institution of Great Britain three coils used by Michael Faraday in his discoveries and investigations in electric magnetic induction, and two samples of heavy glass used by that scientist in his studies of the effect of the dielectric upon electric fields or force, and the rotation of the plane of polarization of light brought about by magnetic fields.

THE BARTOL RESEARCH FOUNDATION

The Bartol Research Foundation was established by the bequest of the late Henry W. Bartol, given to The Franklin Institute for the maintenance of research in the physical sciences, and especially in electricity and in problems of a scientific character growing out of industry. In 1922 three dwelling houses at Nineteenth and Cherry Streets were remodeled and rebuilt to make them suitable for use as laboratories. The buildings were generously equipped with a machine shop, storage batteries, air pumps for both pressure and vacuum, an abundance of electrical circuits, and the usual equipment required in physical or chemical laboratories. Machinists and glass-blowers were provided, and all preparation for research work in physical science was made. The first Fellow on the Bartol Research Foundation was appointed in 1925, and took up his work as a Fellow in September of that year. Since that time research work has been actively pursued at the Bartol Laboratories, with creditable results. The first scientific paper reporting the results of work done at the Laboratories was published in the *JOURNAL* of The Franklin Institute in January, 1926. In September, 1926 the number of Fellows actively at work was increased to six.

HISTORICAL EXTRACTS

(CHRONOLOGICALLY STATED)

About a century ago there lived in Philadelphia two young men who independently conceived the idea of founding an American institution for promoting knowledge of physical science and its diffusion in the arts and industries. One of them was Samuel V. Merrick, then not quite twenty-one years old, and the other was Prof. William H. Keating of the University of Pennsylvania.

Mr. Merrick issued several calls for meetings for the consideration of the project, but no one attended.

Professor Keating had completed his scientific training in France and Switzerland and had returned to the United States full of zeal for the diffusion of science applied to agriculture and the mechanic arts. He was immediately appointed to the newly created chair of Chemistry in its application to Agriculture and the Mechanic Arts, at the University of Pennsylvania, and while thus engaged sought to interest his friends and others in his plans for a scientific and technical society. Mr. Merrick and Professor Keating comparing notes agreed to make another effort to hold another meeting for purposes they both had in mind.

Six gentlemen attended this meeting and a committee was appointed to draft a plan of organization, constitution, etc.

A small meeting was held, a plan approved, and Mr. Merrick and Professor Keating set about to carry it into execution.

Four of the committee selected from 1200 to 1600 names of citizens from the City Directory and invited them to attend another meeting to be held at the county court house at Sixth and Chestnut Streets, Philadelphia, on the evening of February 5, 1824.

The court house was filled to overflowing and from this meeting dates the founding of The Franklin Institute.

1824, February 5. First public meeting held in the county court house, Sixth and Chestnut Streets, for the purpose of organizing The Franklin Institute. A constitution was adopted and a day fixed for the election of officers.

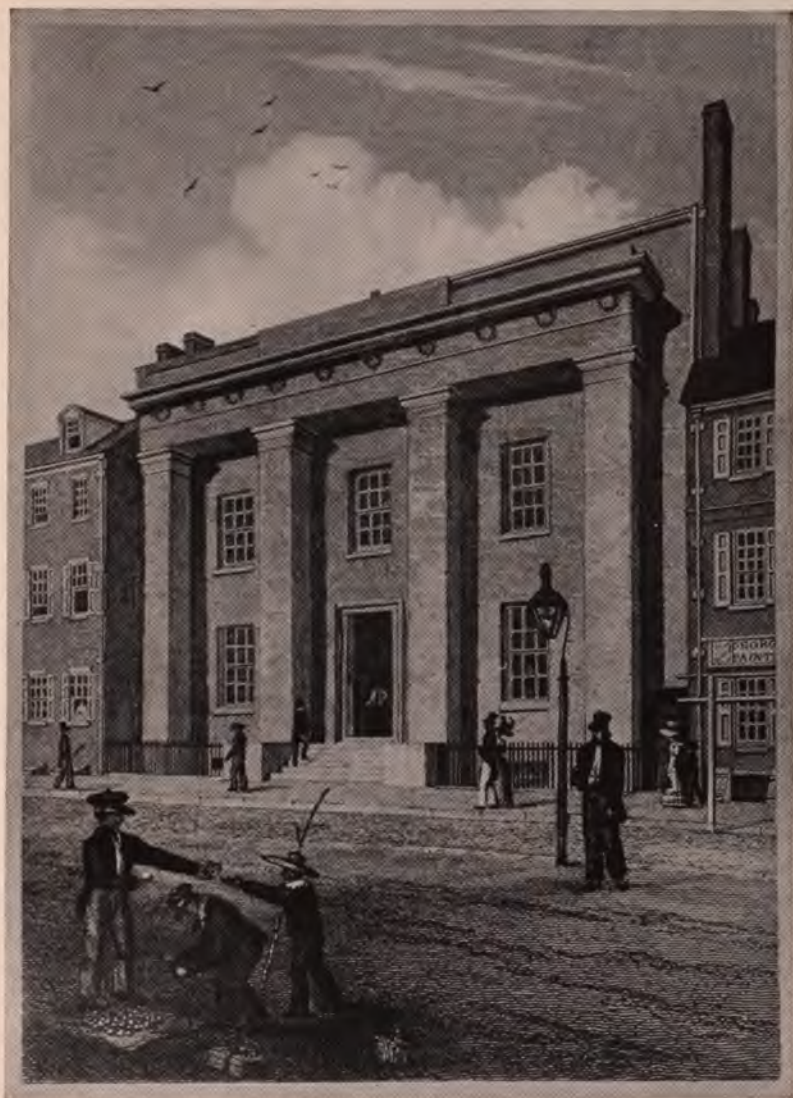
March 4. Committee on Lectures appointed and the Chair of Mineralogy and Chemistry established.

March 30. An act to incorporate The Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts passed by the Legislature and signed by the Governor.

Dr. William H. Keating, Professor of Mineralogy and Chemistry, delivered the first lecture of the first course in the Academy Building, Fourth Street, below Arch, in April.

A Drawing School for members' sons and apprentices was opened in October. John Haviland, professor in charge, assisted by Hugh Bridport, artist and painter of miniatures.

October 18, 19 and 20, first exhibition of products of American industry held in Carpenters' Hall. Thirty premiums were offered for specimens of



THE FRANKLIN INSTITUTE
1825

HISTORICAL EXTRACTS

(CHRONOLOGICALLY STATED)

About a century ago there lived in Philadelphia two young men who independently conceived the idea of founding an American institution for promoting knowledge of physical science and its diffusion in the arts and industries. One of them was Samuel V. Merrick, then not quite twenty-one years old, and the other was Prof. William H. Keating of the University of Pennsylvania.

Mr. Merrick issued several calls for meetings for the consideration of the project, but no one attended.

Professor Keating had completed his scientific training in France and Switzerland and had returned to the United States full of zeal for the diffusion of science applied to agriculture and the mechanic arts. He was immediately appointed to the newly created chair of Chemistry in its application to Agriculture and the Mechanic Arts, at the University of Pennsylvania, and while thus engaged sought to interest his friends and others in his plans for a scientific and technical society. Mr. Merrick and Professor Keating comparing notes agreed to make another effort to hold another meeting for purposes they both had in mind.

Six gentlemen attended this meeting and a committee was appointed to draft a plan of organization, constitution, etc.

A small meeting was held, a plan approved, and Mr. Merrick and Professor Keating set about to carry it into execution.

Four of the committee selected from 1200 to 1600 names of citizens from the City Directory and invited them to attend another meeting to be held at the county court house at Sixth and Chestnut Streets, Philadelphia, on the evening of February 5, 1824.

The court house was filled to overflowing and from this meeting dates the founding of The Franklin Institute.

1824, February 5. First public meeting held in the county court house, Sixth and Chestnut Streets, for the purpose of organizing The Franklin Institute. A constitution was adopted and a day fixed for the election of officers.

March 4. Committee on Lectures appointed and the Chair of Mineralogy and Chemistry established.

March 30. An act to incorporate The Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts passed by the Legislature and signed by the Governor.

Dr. William H. Keating, Professor of Mineralogy and Chemistry, delivered the first lecture of the first course in the Academy Building, Fourth Street, below Arch, in April.

A Drawing School for members' sons and apprentices was opened in October. John Haviland, professor in charge, assisted by Hugh Bridport, artist and painter of miniatures.

October 18, 19 and 20, first exhibition of products of American industry held in Carpenters' Hall. Thirty premiums were offered for specimens of



THE FRANKLIN INSTITUTE
1825

blister steel, bar iron, broadcloths, domestic carpetings, etc. Three hundred exhibits; ten silver medals and two bronze medals were awarded.

1825, April 4. A Mathematical School for members, their sons and apprentices was opened under the direction of Mr. Levi Fletcher.

June 8. This day at high 12 o'clock the corner-stone of the Hall of The Franklin Institute was laid in ancient and Masonic form by the Grand Lodge of Pennsylvania in the presence of the Society. After the appropriate ceremonies had been performed by the Grand Master, prayers were offered up by the Rev. C. G. Potts, Grand Chaplain. The Grand Treasurer deposited in the cavity of the Stone a glass cylinder hermetically sealed containing:

The constitution and by-laws of The Franklin Institute with their first annual report and list of Members, etc.

Medal of William Penn and the Indian chief, sitting under a tree smoking the calumet of peace, on the reverse the allseeing eye, inscribed "Let us look to the Most high who blessed our fathers with peace."

Head of Washington inscribed "George Washington: Commission resigned—Presidency relinquished—1797."

A Silver Medal, with the head of James Monroe, Late President of the United States. On reverse: The Hands of an American officer and an Indian Chief grasped, under the Calumet of Peace. Motto: "Peace and Friendship."

Three Coins of the United States, 1825.

A parchment Scroll on which was inscribed the following:

On the 8th day of June 1825 A. D. 5825 A L and of the independence of these United States the forty-ninth—this Corner Stone of the Hall of The Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts was laid in Ancient and Masonic Form by the Grand Lodge of Pennsylvania.

James Harper, Jr., R. W. G. M.

Thomas Kittera, R. W. D. G. M.

Samuel Badger, R. W. S. G. W.

Michael Nesbit, R. W. J. G. W.

Samuel H. Thomas, R. W. G. S.

Robert Toland, R. W. G. T.

The Franklin Institute was founded the 5th day of February, A. D. 1824, and incorporated the 30th day of March, 1824.

Names of the officers of the year 1825:

President, James Ronaldson.

Vice-presidents, Math. Carey, I. Lukens.

Recording Secretary, W. Strickland; Corresponding Secretary, P. A. Browne.

Treasurer, Thos. Fletcher.

Managers, Paul Beck, Jr., Jno. Harrison, Saml. R. Wood, William H. Keating, Jno. Haviland, Samuel V. Merrick, William Abbot, Jno. D. Eisenhut, Jno. P. Wetheril, James Clarke, Abm. Miller, Jas. Harper, Jr., Adam Ramage, Harvey Lewis, R. M. Patterson, James McAlpin, Wm. Fry, Wm. Kneass, Joseph Donaldson, J. B. Garrigues, Wm. S. Warder, Lloyd Mifflin, A. G. Ralston.

blister steel, bar iron, broadcloths, domestic carpetings, etc. Three hundred exhibits; ten silver medals and two bronze medals were awarded.

1825, April 4. A Mathematical School for members, their sons and apprentices was opened under the direction of Mr. Levi Fletcher.

June 8. This day at high 12 o'clock the corner-stone of the Hall of The Franklin Institute was laid in ancient and Masonic form by the Grand Lodge of Pennsylvania in the presence of the Society. After the appropriate ceremonies had been performed by the Grand Master, prayers were offered up by the Rev. C. G. Potts, Grand Chaplain. The Grand Treasurer deposited in the cavity of the Stone a glass cylinder hermetically sealed containing:

The constitution and by-laws of The Franklin Institute with their first annual report and list of Members, etc.

Medal of William Penn and the Indian chief, sitting under a tree smoking the calumet of peace, on the reverse the allseeing eye, inscribed "Let us look to the Most high who blessed our fathers with peace."

Head of Washington inscribed "George Washington: Commission resigned—Presidency relinquished—1797."

A Silver Medal, with the head of James Monroe, Late President of the United States. On reverse: The Hands of an American officer and an Indian Chief grasped, under the Calumet of Peace. Motto: "Peace and Friendship."

Three Coins of the United States, 1825.

A parchment Scroll on which was inscribed the following:

On the 8th day of June 1825 A. D. 5825 A L and of the independence of these United States the forty-ninth—this Corner Stone of the Hall of The Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts was laid in Ancient and Masonic Form by the Grand Lodge of Pennsylvania.

James Harper, Jr., R. W. G. M.

Thomas Kittera, R. W. D. G. M.

Samuel Badger, R. W. S. G. W.

Michael Nesbit, R. W. J. G. W.

Samuel H. Thomas, R. W. G. S.

Robert Toland, R. W. G. T.

The Franklin Institute was founded the 5th day of February, A. D. 1824, and incorporated the 30th day of March, 1824.

Names of the officers of the year 1825:

President, James Ronaldson.

Vice-presidents, Math. Carey, I. Lukens.

Recording Secretary, W. Strickland; Corresponding Secretary, P. A. Browne.

Treasurer, Thos. Fletcher.

Managers, Paul Beck, Jr., Jno. Harrison, Saml. R. Wood, William H. Keating, Jno. Haviland, Samuel V. Merrick, William Abbot, Jno. D. Eisenhut, Jno. P. Wetheril, James Clarke, Abm. Miller, Jas. Harper, Jr., Adam Ramage, Harvey Lewis, R. M. Patterson, James McAlpin, Wm. Fry, Wm. Kneass, Joseph Donaldson, J. B. Garrigues, Wm. S. Warder, Lloyd Mifflin, A. G. Ralston.

Building Committee of the Hall:

Peter A. Browne, S. R. Wood, S. V. Merrick, James McAlpin, J. B. Garrigues.

Architect, Jno. Haviland.

M. Carpenter, Jas. Clarke.

M. Marble Mason, John Struthers.

M. Bricklayer, Daniel Groves.

The assembly was then addressed by P. A. Browne, Esq., and Adjourned.

(From the minutes of The Franklin Institute, Vol. A.)

Dr. Thomas P. Jones appointed Professor of Mechanics and Natural Philosophy.

October 6, 7 and 8, second exhibition of American manufactures held in Masonic Hall, Chestnut Street, west of Seventh. The number of articles exhibited far exceeded that of the previous year. Eighty-five premiums were offered. Six hundred and ninety-nine articles are listed in the catalogue of exhibits.

1826, January. First number of THE FRANKLIN JOURNAL was issued under the editorial management of Dr. Thomas P. Jones. In addition to his position as Editor, Doctor Jones also acted as Recording Secretary of the Institute and Curator of its collections. April 12, 1828, he was appointed Superintendent of the U. S. Patent Office.

The Institute extended its educational efforts by establishing on April 6 a High School in which Mathematics, Drawing, Geography, History, Latin, Greek, French, Spanish and German were taught. Three hundred and four pupils were in attendance in October, 300 were studying English, 153 French, 105 Latin, 35 Greek, 45 Spanish, 20 German, 300 Elocution, 240 Geography, 231 Drawing, and all of them Mathematics. The School was continued until 1832 and was the predecessor of the Central High School.

October 3, 4, 5, 6, third exhibition of American manufactures was held in Masonic Hall. Silver medals were awarded for soft iron castings, flint glass ware, china from American materials, skirting and japanned leather, white lead, etc. Thirty-four thousand visitors.

1827. Select Committee on Dry Docks made a lengthy illustrated report on the plans submitted by Commodore James Barron, U. S. N., and Captain Thomas Caldwell, giving costs, methods of operation, etc.

October 4, 5, 6 and 8, fourth exhibition of American manufactures held in Masonic Hall. Sixty-two premiums were offered. John L. Wilson, a pupil of the High School of The Franklin Institute, was awarded a silver medal for his map of South America which was exhibited at that time.

1828, October 8, 9, 10 and 11, fifth annual exhibition of American manufactures held in Masonic Hall. Forty-five premiums were offered. Awards were made for specimens of annealed cast iron (the first attempt in this country to anneal iron for general purposes), for the best porcelain made in the United States, for calicos or prints, etc. Robert P. Warner, a pupil of the High School, was awarded a silver medal for his drawing of an air pump.

1829. Committee appointed to investigate the efficiency of moving water as a motive power. The report of the committee, containing much information, and the results obtained from seven hundred experiments, the effect of each of which was submitted to minute calculation, appeared in the JOURNAL

of the Institute for 1831 and 1832. The second portion of the report dealing chiefly with overshot wheels, undershot wheels, and breast wheels was published in March, April, May, June and July, 1841.

1830, September 14 to 19 inclusive, sixth exhibition of American manufactures held in Masonic Hall. The exhibition distinguished itself from all preceding ones by the great excellence of the articles deposited. Thirty-seven premiums were proposed, but three only were adjudged to be due; the first for the best stock or standing vice, the second for a cooking stove, and the third to the maker of a vegetable oil that would answer as a substitute for olive oil. The exhibit of American silk was most noteworthy.

Because of the numerous accidents in steamboats, a committee of five members was appointed to inquire and report whether it be expedient for the Board to institute an investigation into the probable causes of these accidents and the proper remedy to be applied to prevent their recurrence. The appointment of a large committee was suggested to inquire into the probable causes of the explosions of boilers, the best way to obviate the recurrence of these evils, and to limit the extent of their injurious influence. Seventeen members were appointed to undertake this investigation, including Dr. Thomas P. Jones, Prof. Walter R. Johnson, Matthias W. Baldwin, Frederick Graff and Isaiah Lukens. While the work of the committee was still in progress, the Secretary of the Treasury of the United States requested that further extension of the Institute's inquiry include the prevention of steam boiler explosions. This led naturally to an investigation of the strength of materials, and the committee devised apparatus of various forms for the testing of metals, building materials, steam boilers, etc. The correspondence and documents collected by the committee with its extensive report appeared in the issues of the JOURNAL of the Institute for 1831, 1832, 1833 and 1834. The report of experiments on the prevention of boiler explosions was published in January, February, March, April and May, 1836, and the results of the investigations on the strength of materials with numerous illustrations and detailed descriptions of original apparatus appeared in the JOURNAL February to August, 1837.

1831, October 4 to 8 inclusive, seventh exhibition of domestic manufactures held in Masonic Hall. Visitors exceeded forty thousand. Eighty-nine premiums were proposed of which fifteen were adjudged due. Fifteen additional premiums were recommended. A silver medal and one hundred dollars were awarded for a cast iron cooking stove for anthracite coal. Five hundred and forty-two articles were exhibited.

1832. Commenced an investigation into the resources of the Commonwealth considered in relation to its industry and manufactures, an occasion which led to a geological survey of the State.

Walter R. Johnson presented a notable communication on "The Strength of Cylindrical Steam Boilers." The results given are based on the extensive series of experiments made by the Institute's Committee on the Explosion of Steam Boilers.

1833. The Institute was requested by the State Legislature to examine and report upon a bill relating to weights and measures and admeasurement reported to the House of Representatives June 26, 1833. A special committee

of seventeen was appointed to consider the matter. The extensive report which included a detailed statement on the weights and measures of France, England and the United States, as well as an authentication of the Troy pound used in the United States Mint, appeared in the *JOURNAL* for November, 1833, and February to July inclusive, 1834. The Governor requested the committee to superintend the construction of the standards.

The present laws of the State are based on the recommendations made as a result of this investigation.

October 1 to 5 inclusive, eighth exhibition of domestic manufactures held in Masonic Hall. Over seven hundred exhibits. Fifty thousand visitors. Silver medals were awarded for lamps, pianos, rifles, hardware, carpets, cotton and woolen goods, etc.

1834. Joint committee of The Franklin Institute and the American Philosophical Society first began systematic meteorological observations in aid of agricultural and other interests. A circular issued by the committee requested observers to note the direction of the wind; to collect all information concerning storms—their width, direction, velocity, etc.; and the beginning and end of all rains. Detailed instructions were given for taking the "dew point." The committee consisted of eight members, three from the American Philosophical Society and five from The Franklin Institute, Dr. James P. Espy acting as Chairman. This committee continued its work successfully until 1838, when that portion appointed by the Philosophical Society were discharged by that body and the Board of Managers at once appointed a standing Committee on Meteorology to continue the collection of the data. By an Act of the Legislature, passed March 31, 1837, two thousand dollars were appropriated with the further sum of one thousand dollars for each of the two years next ensuing, for the purpose of promoting the improvement of meteorological science, and the furnishing of each county of this commonwealth with the necessary instruments for the observation of such atmospheric changes and phenomena as may be useful for the promotion of knowledge in the science of meteorology.

1835, October 7 to 10 inclusive, ninth exhibition of domestic manufactures held in Masonic Hall. Awards were made for samples of muslin, chintz prints, ginghams, venetian carpeting, straw bonnets, watch dials, water and oil colors, pearl work, leather, porcelain, etc.

1837. The general interest created by the Institute's work gave rise to a movement for the establishment of a school of arts, and a public lot for the erection of buildings was offered by City Councils on High (Market) Street, west of the Schuylkill River. An application for an appropriation from the State failed to pass the Legislature, and after further consideration by the Institute's Committee it was found inexpedient to organize any school at this time, and the plan was abandoned. The movement resulted later in the founding of the Department of Science of the University of Pennsylvania.

1838, November 6 to 17 inclusive, tenth exhibition of domestic manufactures held in Masonic Hall. The profits to the Institute on the present occasion were greater than was ever before realized, notwithstanding the heavy expenses incurred in making preparations. Awards were made for cotton and woolen goods, silks, straw goods, specimens of iron and steel, cutlery, philosophical

apparatus, harness, etc. A chandelier with thirty-eight lights made for the Senate Chamber of the State of Mississippi was one of the striking exhibits.

1839. The JOURNAL for November, 1839, contained a full translation by Prof. John F. Frazer of the paper "Practical Description of the Process Called the Daguerreotype, which Consists in the Spontaneous Reproduction of the Images of Natural Objects in the Camera Obscura, not with Their Colours, but with Great Delicacy in the Gradation of Tints" presented to the French Academy by Daguerre.

1840. A detailed review of Dr. Alexander Dallas Bache's report on education in Europe to the Trustees of Girard College for Orphans appeared in the JOURNAL for January (the report, covering nearly seven hundred pages, was made for use in connection with the organization of Girard College, of which Doctor Bache was President).

October 7 to 21 inclusive, eleventh exhibition of domestic manufactures held in Masonic Hall. Silver medals were awarded for cotton and woolen goods, specimens of iron and steel, hardware and cutlery, a cooking stove, a piano, wall paper, etc. Over one thousand exhibits.

October 18 to 31 inclusive, twelfth exhibition of American manufactures held in the Philadelphia Museum Building, northeast corner of Ninth and Sansom Streets and Welch's Olympic Circus, Walnut Street west of Eighth. No exhibition passed this in point of quality. About nine hundred exhibits.

1843. A request from City Councils for information on the best modes of paving highways. This question was referred to the Committee on Science and the Arts and a sub-committee of eight members was at once appointed. A voluminous report was presented, which gave careful consideration to all phases of the subject. The best construction of asphalt, wood and stone pavements was described. Pavements especially suitable to Philadelphia were noted, as well as plans and specifications, and superintendence and manner of executing the work. The report was accompanied by a map of Philadelphia showing the soils and drainage between the Delaware River and the Schuylkill River, and South Street on the south and Vine Street on the north.

October 17 to 28 inclusive, thirteenth exhibition of American manufactures held in the Philadelphia Museum Building. Silver medals were awarded for printed cotton goods, longcloths, gentlemen's boots and slippers, artificial teeth, etc.

1844, October 14 to 30, fourteenth exhibition of American manufactures held in the Philadelphia Museum Building. Fifty-nine silver medals were awarded for cotton and woolen goods, hardware and cutlery, glass ware, etc., and one hundred and fifty-four certificates of Honorable Mention.

1845, October 21 to November 1 inclusive, fifteenth exhibition of American manufactures held in the Philadelphia Museum Building. Fifty-one first-class premiums were recommended, two hundred and sixteen awards in all. Seventy thousand visitors.

1846, October 20 to 31 inclusive, sixteenth exhibition held in the Philadelphia Museum Building. Silver medals were awarded for gloves, specimens of rolled iron, lamps and gas fixtures, wire rope, coach harness, window shades, musical instruments, etc.

1847, October 19 to 30 inclusive, seventeenth exhibition of American manufactures held in the Philadelphia Museum Building. Silver medals were awarded for blankets, shawls, woolen and worsted yarn, bars of iron, the chandelier made for the Opera House at New York, machinery, glass ware, book binders' dies, chemicals, etc. Seventeen hundred and forty-two exhibits.

1848, October 17 to 28 inclusive, eighteenth exhibition of American manufactures held in the Philadelphia Museum Building. Silver medals were awarded for cotton and woolen goods, carpets, specimens of iron, lamps and gas fixtures, hardware, glass ware, furs, chemicals, etc. A first premium was awarded for a copy of the Webster dictionary, designed as a present to the Queen of England. Seventeen hundred and fifty-one exhibits.

1849, October 16 to 27 inclusive, nineteenth exhibition of American manufactures, held in the Philadelphia Museum Building. Silver medals were again awarded for products made from cotton and woolen materials, hardware and cutlery, also for Daguerreotypes, Talbottypes and Hyalotypes, boots and shoes, chemicals, needlework, etc.

1850. The School of Design for Women was founded by the Institute. Mrs. Sarah Worthington Peter, first Directress. Classes in art and design for women had been conducted by Mrs. Peter in her home, 327 South Third Street, for six years prior to the establishment of the school by the Institute.

In 1851 a room was leased at 70 Walnut Street (West of Third), where the School began as an independent institution under the direction of a special committee appointed by the Board of Managers of the Institute. This arrangement continued for two years when, in the spring of 1853, control was transferred to a separate organization, and Elliott Cresson, one of the Institute's benefactors, became the President.

October 15 to 26 inclusive, twentieth exhibition of American manufactures held in the Philadelphia Museum Building. Silver medals were awarded for tin ware, dental materials, chemicals, leather, saddlery and harness, philosophical instruments, etc. Nine hundred and fifty exhibits.

1851, October 21 to November 1, twenty-first exhibition of American manufactures held in the Philadelphia Museum Building. Awards were made for agricultural implements, carpetings, hardware, cabinet ware, lamps and gas fixtures, leather, chemicals, etc.

1852, October 19 to 30 inclusive, twenty-second exhibition of American manufactures held in the Philadelphia Museum Building. One special award, four gold medals, five recall first premiums (silver medals), eighty-six first premiums, fifty-two second premiums and thirty-eight third premiums were awarded. Ten exhibits were referred to the Committee on Science and the Arts. Twelve hundred exhibitors, one hundred thousand visitors. In number of exhibitors and articles displayed, as well as their beauty, novelty and value this exhibition was superior to any previous one held by the Institute.

1853, October 18 to November 3 inclusive, twenty-third exhibition of American manufactures held in the Philadelphia Museum Building. One hundred and eighty-six awards were made. Over eight hundred exhibits.

1854, November 14 to December 2, inclusive, twenty-fourth exhibition of American manufactures held in Dr. David Jayne's granite building on Dock

Street. Premiums were offered for perfumery and soaps, straw goods, chemicals, furs, saddlery and harness, leather, dental materials, surgical instruments.

1856, November 11 to 29 inclusive, twenty-fifth exhibition of American manufactures held in Doctor Jayne's building on Dock Street. Silver medals were awarded for specimens of rolled iron, hardware, stoves and heaters, cabinet ware, lamps and gas fixtures, silver ware and jewelry, cotton and woolen goods, chemicals, etc. Twelve hundred and twenty-six exhibits.

1858, October 15 to November 13, twenty-sixth annual exhibition of American manufactures held in the State Armory Building and adjacent grounds (Sixteenth and Filbert Streets). Awards were made for musical instruments, books, stationery, printers' type and materials, boots and shoes, needlework, coachwork, dental materials, philosophical apparatus, glass and china, lamps and gas fixtures, machinery, etc. A special pamphlet report on the sewing machines deposited at this exhibition was published in 1859.

1863. The Guardians of the Poor requested the Institute to communicate to them the most efficient means of protecting the Alms House Buildings from lightning.

A sub-committee of the Committee on Science and the Arts, to whom the problem was referred, made a survey of the grounds and buildings and recommended the installation of a system of lightning rods, properly connected and grounded. Detailed directions were given for making this installation.

At the Stated Meeting of the Institute held April 21, 1864, President William Sellers read a paper on a System of Screw Threads and Nuts. He pointed out the importance of a uniform system of screw threads, bolt-heads and nuts and offered suggestions for establishing such a system. Tables, diagrams and formulæ were submitted and comparisons were made with the English system. After a discussion it was voted to send copies of Mr. Seller's paper to other societies for consideration and approval. A special committee was appointed to investigate the question of a proper system of screw threads, bolt-heads and nuts, to be recommended by the Institute, for the general adoption by American engineers. The committee presented its report in December and recommended the adoption of certain forms and proportions. Copies of the report and resolutions were forwarded to the various departments of the United States Government and to the Superintendents and Master Mechanics of railroad companies requesting them to use their influence to promote the adoption of a uniform system of screw threads, bolt-heads, and nuts, by requiring all builders under any new contracts to conform to the proportions recommended. Copies were also sent to mechanical and engineering associations and institutions, machine and engine shops throughout the country with a request that they use their influence in favor of the proposed system. The Sellers or Franklin Institute system was adopted by the United States Government in 1868, in the following year the Pennsylvania Railroad Company ordered a set of gauges of the new form and adopted it and in 1872 the Master Car Builders' Association recommended the system as a standard.

1869. Organized the Expedition to observe the Solar Eclipse at Mount Pleasant, Iowa, on August seventh. A party of volunteers, twenty in number, under the direction of Henry Morton, attended to the various duties in connection with the observation. The telescopes were borrowed and the transportation

for the party and equipment was furnished by the railroad companies. The first account of the work of the members of this expedition appears in the *JOURNAL* of the Institute for September, 1869. (Vol. 88, p. 200.)

A committee of three was appointed to consider the subject of memorializing Congress in reference to an exposition of arts and manufactures on the centennial anniversary of American Independence, to be held in the city of Philadelphia. This action resulted in the appointment of a special committee of five to bring the matter to the attention of Select and Common Councils and request that they memorialize Congress on the subject. A joint committee was organized, consisting of nine members from each chamber of Councils, three members from each House of the Legislature, and five representatives of the Institute, for the purpose of obtaining such aid as would make such an exhibition truly international in its character.

The efforts of this committee resulted in the passage, by Congress, on March 3, 1871, of an Act to Provide for celebrating the 100th Anniversary of American Independence by holding an International Exhibition of Arts, Manufactures and Products of the Soil and Mine in the City of Philadelphia, and the State of Pennsylvania in the year 1876.

1871. The committee appointed June 21, 1871, to examine into the modes of determining the horse-power of steam boilers presented a preliminary report which appeared in the *JOURNAL* for August, 1871. The concluding report was published in August, 1872, and was fully discussed at the Stated Meeting of the Institute held in October, 1872 (*J. F. I.*, December, 1872, Vol. 94, p. 377). It was voted to increase the membership of the Committee having charge of the experiments and have the investigation continued. A majority and minority report were presented to the Stated Meeting of the Institute on November 19, 1873, and appear in the *JOURNAL* for December, 1873. (Vol. 96, p. 396.)

1873. At the Stated Meeting of the Institute held February 19, 1873, the suggestions made by Prof. J. P. Lesley in a letter to the Governor of Pennsylvania dated February 1 (*J. F. I.*, Vol. 95, p. 194) urging the establishment of a geological survey of the state were approved. In his letter Prof. Lesley called attention to the needs and advantages of a survey, the importance of accurate geological maps of the state and submitted suggestions for a complete working corps for the operations of the various departments of the survey. He estimated that the annual expense for personnel, laboratory, traveling expenses, instruments, publications and printing would be \$47,000.

On May 14, 1874, the Legislature passed a bill providing for a state survey, which was signed by the Governor on the same day. The bill included an appropriation of \$35,000 per year for three years. (This was the beginning of the Second Geological Survey of Pennsylvania.)

The April issue of the *JOURNAL* contains a report of the Committee on the Causes of Conflagrations and the Methods of their Prevention, with an exhaustive paper on "The Light Petroleum Oils; considered as to their safety or danger, in various domestic uses" prepared by Dr. William H. Wahl for the use of the committee.

At the Stated Meeting of the Institute held March 19, 1873, it was resolved to recommend and petition the Legislature to pass an act or acts embodying the following points: To appoint a competent commission to investigate and

determine some satisfactory test whereby it can be ascertained which oils or compounds are safe to be used in lamps and which are unsafe. To make it a penal offence to manufacture, compound, sell or knowingly use any oil or compound that will not stand the required test, and that in case of death resulting from the same, the guilty person or persons shall be liable to conviction for manslaughter.

1874, October 6 to November 12 inclusive, twenty-seventh exhibition of American manufacturers held in the Pennsylvania Railroad Station, Thirteenth and Market Streets, Philadelphia (site of the Wanamaker Store). Held to celebrate the fiftieth year of the founding of the Institute. Number of exhibitors—twelve hundred and fifty-one; paid admissions—two hundred and sixty-seven thousand six hundred and thirty-eight. Two hundred and one silver medals, two hundred and twenty-eight bronze medals and two hundred and twenty-two certificates of Honorable Mention were awarded.

1875. An ordinance passed by Councils June 5 requested the Mayor to appoint a commission of five scientific and practical engineers to be selected from not less than eight names recommended by the Board of Managers of The Franklin Institute, to whom in connection with the Chief Engineer of the Water Department, shall be referred the entire subject of the present and future water supply of Philadelphia. The Commission organized on June 29 and made a thorough investigation of the various pumping stations and reservoirs. Special examinations were made of the Wissahickon valley, the valley of the Perkiomen, the upper Schuylkill River and the Delaware River above tide, particularly at New Hope, Easton and the Water Gap. The report of the Commission was presented to Councils before the close of the year and contained nine recommendations for the improvement of the present water supply and special provisions for the centennial year. For future supply the Perkiomen reservoir and conduit seemed to be reasonably practicable. Abstracts of the Commission's report appear in the *JOURNAL* for November and December, 1875 (Vol. 100, pp. 292, 368).

In September the Board of Managers learned of the measures being taken to establish a Museum of Industrial Art similar to the South Kensington Museum, London, and gave the movement their endorsement. In December an invitation was extended to the Institute to choose one of the trustees of the Museum, and in January of the following year Mr. J. B. Knight, then Secretary of the Institute, was chosen to act in that capacity. For ten years the Institute had a voice in the management of the Museum.

1882. A resolution passed at the meeting of the Institute held May 7, requested the President to appoint a committee to give expression of the views of the Institute concerning the pollution of the waters of the Schuylkill River from the entrance of sewage near the eastern end of the Girard Avenue bridge. The report of the Committee appears in the issue of the *JOURNAL* for August, 1882 (Vol. 114, p. 135). Attention is called to the advantage which would arise to the general health of the city from the construction of an intercepting sewer along the eastern banks of the Schuylkill from Manayunk or beyond, and with an outlet sufficiently below the densely populated portions of the city as not to be objectionable.

In conformity with an ordinance passed June 7, the Mayor appointed a

Board of Experts consisting of one civil engineer, one mechanical engineer and one hydraulic engineer selected from nine names submitted by the American Society of Civil Engineers and the Institute, and the Chief Engineer of the Water Department to "report to Councils the methods pursued in the Water Department, together with their recommendations of what should be done for the present and future supply of the City, with such itemized estimates as will enable the cost to be determined." The preliminary report of this Commission was presented to Councils on October 14, 1882, and appeared in the *JOURNAL* of the Institute for April, 1883. It contained recommendations for the installation of machinery and apparatus in the several pumping stations, the completion and extension of reservoirs and the management of the stations. The final report was transmitted to Councils on April 5, 1883 (*J. F. I.*, Vol. 116, p. 321). Special attention was given to the future supply of the city and the reduction of waste. The use of meters for factories and large public buildings was suggested.

A paper on the Prevention of Fires in Theatres was read at the Stated Meeting held June 21 by Charles J. Hexamer, C. E., (*J. F. I.*, Vol. 114, pp. 125, 211). At the close of the discussion which followed the reading of the paper, it was voted to appoint a committee to investigate the subject of the prevention of fires in theatres. The report of this committee was presented to the Stated Meeting of the Institute on April 18, 1883, and printed in the *JOURNAL* for June (Vol. 115, p. 428). It contains much information on theatre fires, the hazards of artificial light, heating apparatus, fireworks, the use of paper wads in guns, the situation of the necessary work shops, paint lofts and spontaneous combustion. Considerable attention is given to the fire-proof drop curtain, and after having obtained information from many sources the committee expressed the opinion that woven asbestos cloth is most satisfactory. The report contains thirty-eight recommendations intended to make places of amusement more safe, nearly all of which have since been adopted.

1884, September 2 to October 11. The International Electrical Exhibition, held in the Pennsylvania Railroad Station at 32nd and Market Streets and a building especially erected at the northwest corner of 32nd Street and Lancaster Avenue.

Without federal or state aid the Institute held the first great electrical exhibition in this country. Total number of paid admissions, 282,779; receipts from sale of tickets, \$98,639.70. Two hundred and sixteen exhibitors.

By an act of congress the United States Electrical Commission was created for the purpose of conducting a national conference of electricians. This commission issued invitations to a large number of scientific gentlemen, both foreign and American, who assembled in conference on September 8 and continued their deliberations for six days.

During and immediately after the exhibition the most complete and extended series of tests attempted to that time were made to determine the characteristics of all the more important types of electrical apparatus and appliances then commercially used. The results of these tests were published in the *JOURNAL* and in pamphlet form during 1885 and 1886 as the Reports of the Examiners.

The organization of the American Institute of Electrical Engineers this year resulted from the holding of the electrical exhibition and the international conference of electricians.

1885, September 15 to October 31. The Novelties Exhibition held in the buildings erected for the use of the electrical exhibition; this was the twenty-ninth exhibition and was devoted to novelties in American manufactures. Three hundred and seventy-five exhibitors.

Awards of medals and diplomas were made for articles of novel or intrinsic merit.

1886. At the Stated Meeting of the Institute held October 20, 1886, it was resolved that the subject of organizing a State Weather Service be referred to a special committee, to be appointed by the President, with the request to report a plan for the same, if possible, to the Stated Meeting of the Institute in November.

On December 15 the special committee presented its report and recommended immediate organization of a "State Weather Service" with a volunteer force of observers; that the coöperation of railroad, telegraph and telephone companies and newspapers be solicited; that all institutions of learning throughout the state be invited to take an active interest in the collection of meteorological data and the study of the science; that an effort be made to secure an appropriation of \$3000 from the state, for the purchase of instruments and for the publication of the results of observations in tabulated form.

The offer of the Chief Signal Officer to furnish a member of the Signal Corps to assist in the work was accepted.

An Act to establish a State Weather Service was at once drafted and passed by the Legislature and the first Summary of Meteorological Reports giving the results of observations made in September appeared in October, 1887.

The service was in operation until May, 1891, when the State discontinued the appropriation.

1889. President Joseph M. Wilson, at the Stated Meeting of the Institute held November 20, made some remarks upon his observations of trade schools in France and England, having been charged with the task of investigating the organization and mode of operation of such institutions on behalf of the projected school of Mr. A. J. Drexel, of Philadelphia.

Mr. Wilson's complete report "On Schools: with particular reference to Trade Schools," appeared in the issues of the JOURNAL February to October inclusive, 1890.

1897. The Board of Health of the City of Philadelphia requested the appointment, by The Franklin Institute, of a committee to coöperate with the Board, in considering ways and means for the abatement of the growing evils arising from the increasing use of bituminous coal within the city limits.

At the meeting of the Institute of April 21, 1897, the regular order of business was suspended and the evening was devoted to the consideration of "The Smoke Nuisance and its Regulation." The discussion was introduced by a paper giving a brief historical account of the subject and some data having especial reference to the smoke question as it affects Philadelphia.

Board of Experts consisting of one civil engineer, one mechanical engineer and one hydraulic engineer selected from nine names submitted by the American Society of Civil Engineers and the Institute, and the Chief Engineer of the Water Department to "report to Councils the methods pursued in the Water Department, together with their recommendations of what should be done for the present and future supply of the City, with such itemized estimates as will enable the cost to be determined." The preliminary report of this Commission was presented to Councils on October 14, 1882, and appeared in the *JOURNAL* of the Institute for April, 1883. It contained recommendations for the installation of machinery and apparatus in the several pumping stations, the completion and extension of reservoirs and the management of the stations. The final report was transmitted to Councils on April 5, 1883 (*J. F. I.*, Vol. 116, p. 321). Special attention was given to the future supply of the city and the reduction of waste. The use of meters for factories and large public buildings was suggested.

A paper on the Prevention of Fires in Theatres was read at the Stated Meeting held June 21 by Charles J. Hexamer, C. E., (*J. F. I.*, Vol. 114, pp. 125, 211). At the close of the discussion which followed the reading of the paper, it was voted to appoint a committee to investigate the subject of the prevention of fires in theatres. The report of this committee was presented to the Stated Meeting of the Institute on April 18, 1883, and printed in the *JOURNAL* for June (Vol. 115, p. 428). It contains much information on theatre fires, the hazards of artificial light, heating apparatus, fireworks, the use of paper wads in guns, the situation of the necessary work shops, paint lofts and spontaneous combustion. Considerable attention is given to the fire-proof drop curtain, and after having obtained information from many sources the committee expressed the opinion that woven asbestos cloth is most satisfactory. The report contains thirty-eight recommendations intended to make places of amusement more safe, nearly all of which have since been adopted.

1884, September 2 to October 11. The International Electrical Exhibition, held in the Pennsylvania Railroad Station at 32nd and Market Streets and a building especially erected at the northwest corner of 32nd Street and Lancaster Avenue.

Without federal or state aid the Institute held the first great electrical exhibition in this country. Total number of paid admissions, 282,779; receipts from sale of tickets, \$98,639.70. Two hundred and sixteen exhibitors.

By an act of congress the United States Electrical Commission was created for the purpose of conducting a national conference of electricians. This commission issued invitations to a large number of scientific gentlemen, both foreign and American, who assembled in conference on September 8 and continued their deliberations for six days.

During and immediately after the exhibition the most complete and extended series of tests attempted to that time were made to determine the characteristics of all the more important types of electrical apparatus and appliances then commercially used. The results of these tests were published in the *JOURNAL* and in pamphlet form during 1885 and 1886 as the Reports of the Examiners.

The organization of the American Institute of Electrical Engineers this year resulted from the holding of the electrical exhibition and the international conference of electricians.

1885, September 15 to October 31. The Novelties Exhibition held in the buildings erected for the use of the electrical exhibition; this was the twenty-ninth exhibition and was devoted to novelties in American manufactures. Three hundred and seventy-five exhibitors.

Awards of medals and diplomas were made for articles of novel or intrinsic merit.

1886. At the Stated Meeting of the Institute held October 20, 1886, it was resolved that the subject of organizing a State Weather Service be referred to a special committee, to be appointed by the President, with the request to report a plan for the same, if possible, to the Stated Meeting of the Institute in November.

On December 15 the special committee presented its report and recommended immediate organization of a "State Weather Service" with a volunteer force of observers; that the coöperation of railroad, telegraph and telephone companies and newspapers be solicited; that all institutions of learning throughout the state be invited to take an active interest in the collection of meteorological data and the study of the science; that an effort be made to secure an appropriation of \$3000 from the state, for the purchase of instruments and for the publication of the results of observations in tabulated form.

The offer of the Chief Signal Officer to furnish a member of the Signal Corps to assist in the work was accepted.

An Act to establish a State Weather Service was at once drafted and passed by the Legislature and the first Summary of Meteorological Reports giving the results of observations made in September appeared in October, 1887.

The service was in operation until May, 1891, when the State discontinued the appropriation.

1889. President Joseph M. Wilson, at the Stated Meeting of the Institute held November 20, made some remarks upon his observations of trade schools in France and England, having been charged with the task of investigating the organization and mode of operation of such institutions on behalf of the projected school of Mr. A. J. Drexel, of Philadelphia.

Mr. Wilson's complete report "On Schools: with particular reference to Trade Schools," appeared in the issues of the JOURNAL February to October inclusive, 1890.

1897. The Board of Health of the City of Philadelphia requested the appointment, by The Franklin Institute, of a committee to coöperate with the Board, in considering ways and means for the abatement of the growing evils arising from the increasing use of bituminous coal within the city limits.

At the meeting of the Institute of April 21, 1897, the regular order of business was suspended and the evening was devoted to the consideration of "The Smoke Nuisance and its Regulation." The discussion was introduced by a paper giving a brief historical account of the subject and some data having especial reference to the smoke question as it affects Philadelphia.

The discussion was continued by brief addresses from eleven prominent engineers and the president of the Board of Health.

The discussion was resumed at the meeting of May 19 by ten engineers of note and the president of the Board of Health.

It was the unanimous opinion of those present at the meeting of September 15, that the frequent discharge of dense black smoke from furnaces of stationary boilers is avoidable and should not be permitted in the city and that the emission of smoke from locomotives and furnaces might be greatly reduced if the coöperation of firemen and employers were enlisted with an earnest intention to abate the nuisance. Resolutions to this effect were approved and it was directed that copies be sent to the Mayor, the president of the Board of Health and to the president of Councils. At this meeting descriptions were presented of improved furnaces and automatic stokers. The representatives of five of the leading manufacturers were present and described their apparatus illustrating their remarks with the aid of models and lantern slides.

The discussion was concluded at the meeting of October 20 when ten stokers and furnaces were described.

A detailed account of the above discussion appeared in the issues of the JOURNAL for June, July and December, 1897, and January and February, 1898.

1899. National Export Exposition held in conjunction with the Commercial Museum of Philadelphia.

The seventy-fifth anniversary of the founding of the Institute was observed by a series of conferences and lectures held in the Convention Hall of the exposition on October 2 to 7 inclusive.

1901. A special committee appointed by the President to consider the advisability and feasibility of the adoption of the metric system in the United States, presented its report on February 19, 1902.

The following preambles and resolutions submitted by the Committee were unanimously adopted:

WHEREAS, It is desirable to obtain an international standard of weights and measures, also to simplify and regulate some of our existing standards; and

WHEREAS, The metric system is commendable, not only as a suitable international standard, but also for facility of computation, convenience in memorizing and simplicity of enumeration;

Resolved, That The Franklin Institute approves of any movement which will promote the universal introduction of the metric system with the least confusion and expense.

Resolved, That the National Government should enact such laws as will ensure the adoption of the metric system of weights and measures as the sole standard in its various departments as rapidly as may be consistent with the public service.

The report, discussion and important correspondence on the subject were published in the JOURNAL for June, July and August, 1902.

In order to promote both domestic and foreign commerce, the following preambles and resolutions were adopted at the Stated Meeting of the Institute held on December 18:

WHEREAS, Greater and cheaper transportation facilities are essential to the development of our domestic and foreign commerce;

WHEREAS, The limited appropriations made by the National Government are inadequate to meet the requirements of the country, covering only a small percentage of the approved projects;

WHEREAS, The former policy of authorizing the improvement of our waterways by private capital resulted in a marked development without material cost or risk to the general Government;

WHEREAS, Early and economical results may be secured by a partial return to this method in localities where no provision has been made for immediate improvement; therefore, be it

Resolved, That the proper department of the general Government should be empowered to authorize the improvement, by individuals or corporations, of such rivers, harbors, canals or other waterways as are not provided for under the River and Harbor or the "Sundry Civil" Bills, with authority to collect tolls, upon plans and regulations to be approved by the said department; PROVIDED, that no part of the funds for such work shall be drawn from the public treasury of the United States. Also,

WHEREAS, The commercial and industrial interests of the country have attained such magnitude as to require a more systematic organization for their regulation and development;

WHEREAS, A measure known as Senate Bill No. 738 has been introduced into Congress for the purpose of establishing a Department of Commerce and Industries; therefore, be it

Resolved, That the establishment of such a Department of Commerce and Industries has the hearty approval of The Franklin Institute, and its early inauguration is recommended.

1906. At the Stated Meeting of the Institute, held September 19, at the conclusion of the reading of a paper on "The Relations of the Government to Our Waterways" by Prof. Lewis M. Haupt, the following preamble and resolutions were unanimously adopted:

WHEREAS, It is the present established policy of the general Government to provide ample facilities for the water-borne commerce of the United States and to emancipate interstate commerce from the obstructions imposed by tolls or restricted canals under private or corporate control, and

WHEREAS, This policy has been successfully inaugurated in all parts of the country with the exception of the early canals skirting the most populous and important cities of the Atlantic seaboard, and

WHEREAS, The best interests of the country demand the early construction of capacious canals connecting the interior waters of the bays and sounds of this coast, for commercial purposes as well as for national defense, and

WHEREAS, The most important and least expensive of these links is the one connecting the waters of the Chesapeake and Delaware Bays by a canal which is less than fourteen miles in length, and which has a trunk of only nine feet in depth and sixty-six minimum width, in which the Government is a joint owner, and concerning which its officials and commissions have

invariably reported that it is vital for the protection of the coast, as has been demonstrated in our several wars, and

WHEREAS, Congress has again authorized the appointment of a Commission to ascertain the expense of securing control of the works and franchises of the Chesapeake and Delaware Canal with a view to the acquisition of the aforesaid canal as a free and open waterway, which Commission is to report at the coming session of Congress.

Be it therefore *Resolved*, That The Franklin Institute of Pennsylvania reaffirms its position as to the urgent necessity of enlarging our coastwise waterways, and especially the Chesapeake and Delaware Canal for commercial and strategic purposes at the earliest practicable date.

Resolved, That a committee be appointed to present this resolution to the Commission at the public hearing to be held in this city on the 27th instant.

1912. Centenary of the Introduction of Gas as an Illuminant observed on April 18 and 19.

The Institute with the coöperation of the American Philosophical Society, the American Chemical Society and the American Gas Institute arranged a series of meetings and lectures dealing with subjects relating to gas and gas manufacture. An important feature of the celebration was a loan exhibition of models, photographs, sketches, prints, manuscripts and drawings relating to every phase of the gas industry; also specimens of gas meters, lamps and burners, gas stoves and other appliances.

1914. Conducted meeting in Philadelphia on June 3 in commemoration of the thirtieth anniversary of the International Electrical Exhibition. Addresses were made by Messrs. E. W. Rice, Charles F. Brush and Frank J. Sprague.

1915. First awards of The Franklin Medal.

1916. Format of the JOURNAL changed from 6 x 9 inches to 6½ x 9½ inches with increase in the number of reading pages.

1917. Established and maintained a recruiting and examination station for applicants for admission to the Aviation Service of the United States Army. Established School of Navigation for the United States Shipping Board. Conducted free Radio School for men of the selective draft.

1920. Published "Physics of the Air," by W. J. Humphreys, C.E., Ph.D., 665 pages, illustrations, diagrams, octavo.

1921. Received \$1,208,468.32 from the bequest of Henry W. Bartol, a life member of the Institute, for research. "Bartol Research Foundation," established for the purpose of conducting researches relating to fundamental problems in physical science, particularly those in the field of electricity, and for the investigation of specific problems of a scientific nature which may arise in the industries.

1922, March 6 to 10 inclusive. F. W. Aston, M.A., D.Sc., F.R.S., Fellow of Trinity College, Cambridge, England, delivered a course of lectures on "Atomic Weights and Isotopes."

1923, April 9 to 13 inclusive. Sir Joseph John Thomson, O.M., F.R.S., LL.D., Ph.D., D.Sc., Master of Trinity College, Cambridge, England, delivered a series of lectures on "The Electron in Chemistry." Subsequently published in book form, 144 pages, octavo.

1923. Laboratory for conducting the work of the Bartol Research Foundation, provided for by the reconditioning of three buildings on the Institute's property, at Nineteenth and Cherry Streets.

1924, September 17, 18, 19. The centennial anniversary of the founding of The Franklin Institute in 1824 was celebrated by noteworthy exercises extending over three days, and at the same time exercises inaugurating the activities of the Bartol Research Foundation were held. These exercises consisted of formal conferences of a scientific nature, lectures by distinguished scientists, receptions, and the formal opening of the Bartol Research Laboratories, and were terminated by a great dinner given to the delegates and members of the Institute.

The delegates were received formally on the first day of the celebration. Lectures by forty-six world-renowned scientists and inventors were delivered during the three days. The hospitable citizens of Philadelphia entertained the delegates and visitors by luncheons, dinners, and lawn fêtes. Appropriate exercises were held at the Bartol Laboratories to signalize the completion of the preparations for active work under the Foundation.

The final centenary dinner brought together what was probably the most distinguished gathering of scientists from all the world ever collected in America. Greetings and congratulations, both formal and informal, were presented from all the institutions and societies represented. Speeches were made by at least one representative of every foreign country from which a delegate was present, and by representatives of the University of Pennsylvania and Princeton University. All expressed congratulations to the Institute for its honorable history and its long record of usefulness and all uttered confident good wishes for continued growth and success.

The lectures delivered during the Centenary Celebration were subsequently published by the Institute in the form of monographs.

1925, October 1. The first Bartol Research Foundation Fellow was appointed and active research work at the Laboratories was inaugurated.

1926, January 1. New cover design for JOURNAL adopted.

May 12. First celebration of Medal Day. All medals awarded during the year presented on this day.

December 26, 27, 29, 30. Inauguration of Christmas Week Lectures by Prof. R. W. Wood, Johns Hopkins University. Lectures on "Recreations with Radiations." Three monetary prizes awarded for best lecture note-books.

1927, January 12. Establishment of the James Mapes Dodge Lecture Foundation.

SPECIAL MEMORIAL LIBRARY FUNDS

Bloomfield H. Moore Memorial Fund. Established by Mrs. Clara Jessup Moore as a memorial to her husband. For the purchase and care of books.

Memorial Library Fund of the International Electrical Exhibition of 1884. For the purchase of books of reference on subjects relating to electricity.

James T. Morris Memorial Fund. Established by his brother John T. Morris. For the purchase of books on mechanics.

M. Carey Lea Fund. Bequest of Matthew Carey Lea. For the purchase of books on physics and chemistry.

Harry W. Jayne Fund. For the purchase of books on chemistry.

Howard N. Potts Library Fund. Bequest of Howard N. Potts. For the purchase of books.

Louis Edward Levy Fund. Founded by his family. For the purchase of books on the reproductive arts.

Ware Library Fund. Bequest of Lewis S. Ware. For the purchase and care of all publications on sugar.

Isaac B. Thorn Memorial Fund. Founded by his daughter, Miss Mary Thorn. Previously given as a scholarship fund and now permitted to be used for the purchase and care of books.

CHARTER AND BY-LAWS

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS

An Act, to incorporate The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts.

SECTION 1. Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania in General Assembly met, and it is hereby enacted by the authority of the same, That the subscribers to the association called The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, and all such persons as may hereafter be admitted members of the same, shall be, and they are hereby declared to be, a body politic and corporate, by the name and style of "THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS," to have perpetual succession, to sue and be sued, implead and be impleaded, in all courts of record or elsewhere, to use a common seal, and break, alter, and renew the same at pleasure, and to take, hold, and enjoy lands, tenements, and hereditaments; Provided that the yearly income of the real estates held by them shall not exceed two thousand dollars.

SEC. 2. And be it further enacted by the authority aforesaid, That the objects of the said corporation shall be the promotion and encouragement of manufactures and the mechanic and useful arts, by the establishment of popular lectures on the sciences connected with them, by the formation of a cabinet of models and minerals, and a library, by offering premiums on all objects deemed worthy of encouragement, by examining all new inventions submitted to them, and by such other measures as they may judge expedient.

SEC. 3. And be it further enacted by the authority aforesaid, That the members of the said corporation shall consist of manufacturers, mechanics, artisans, and persons friendly to the mechanic arts; they shall pay such sum annually, or in gross, as shall be required by the by-laws of the said corporation for an annual, or life, subscription; Provided that nothing herein contained shall be construed to prevent the said corporation from electing honorary or corresponding members, who may be exempted from such payments and other duties of membership, in such manner and to such extent as may be prescribed by the by-laws of the said corporation.

SEC. 4. And be it further enacted by the authority aforesaid, That the officers of the said corporation shall be a president, two vice-presidents, a recording secretary, a corresponding secretary, a treasurer, and twenty-four managers, who shall, together, constitute a board of managers of the said corporation, and such other officers as the said corporation shall deem needful; two-thirds of the managers shall be manufacturers or mechanics; the said

officers shall be elected at an annual meeting of the said corporation, to be held on the third Thursday of January; if an election shall not take place on that day, the corporation shall not for that cause be dissolved, but an election shall be held as soon afterwards as may be, and until such election the officers in place shall continue to act; public notice of all elections shall be given in such manner as may be prescribed by the by-laws of the said corporation; the present officers of the said association are hereby constituted the officers of the corporation hereby created and shall continue to hold their respective offices till otherwise elected under the provisions of this act; Provided always, that the said corporation shall have power to increase the number of vice-presidents and managers hereinbefore mentioned, to such number as may be deemed advisable and convenient at a stated meeting of the said corporation, the same public notice of such intended alteration being previously given as may be required to be given of the election of officers of the said corporation.

SEC. 5. And be it further enacted by the authority aforesaid, That the duties and rights of the members of the said corporation, the powers and functions of the members of the said corporation, the powers and functions of the officers thereof hereinbefore mentioned, and of such others as may hereafter be added, the mode of supplying vacancies in office, the times of meeting of the said corporation, and of the board of managers, the numbers which shall constitute a quorum at any such meetings, the mode of electing members, the terms of their admission, the causes which shall justify their suspension or expulsion from the corporation, and all other concerns of the said corporation shall be regulated by the by-laws and ordinances of the said corporation hereafter to be made, which the said corporation is hereby authorized and empowered to make and alter, in the manner which may be therein mentioned; Provided that the said by-laws or ordinances shall not be repugnant to, or inconsistent with, the constitution or laws of the United States or of this Commonwealth.

OFFICE OF THE CLERK OF THE SENATE OF THE COMMONWEALTH OF
PENNSYLVANIA,

March 30th, 1824.

I certify that the foregoing Bill passed both branches of the Legislature, and received the signature of the Governor on this day. As witness my hand the day and year above written.

(Signed.)

JNO. DUPUY, *Clerk.*

An Act to amend and alter the Act incorporating The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts.

WHEREAS, The Act approved March thirtieth, one thousand eight hundred and twenty-four, incorporating The Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, has been found insufficient and inconvenient for accomplishing the objects of said corporation, and the said corporation has applied for alteration and amendment thereof.

SECTION 1. Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania, in General Assembly met, and it is

hereby enacted by the authority of the same, that the present members of said corporation, and all such persons as may hereafter become members thereof, shall be, and are hereby created, a body politic and corporate by the name of "THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS," and shall have perpetual succession, be able to sue and be sued, to plead and be impleaded, to have and use a common seal, and the same to break, alter and renew at pleasure, and shall be able to take, hold, purchase and enjoy such real and other estates of any nature or kind whatsoever as they may obtain by purchase, devise, bequest or gift, and the same at their pleasure to sell, lease, mortgage, pledge, encumber, or dispose of as they may deem proper or convenient for promoting the objects of the said corporation; and the said corporation shall have the like power over any real estate or other estates now owned or held by them; *provided*, that the clear yearly value of the real estate at any time held by them shall not exceed ten thousand dollars.

SEC. 2. That it shall be lawful for the said corporation to raise funds for the payment of its present indebtedness, and for all other purposes of the said corporation, to create and sell such number of shares of stock, at ten dollars each, as may be deemed proper to represent the estates of the said corporation, and the certificates of such stock shall be in such form, be transferable in such manner, subject to such payments, and entitle the holder thereof to such privileges, as the said corporation may, by its By-Laws in reference to such stock, grant and direct.

SEC. 3. The object of the said corporation shall be the promotion and encouragement of manufactures and the mechanical and useful arts, by the establishment of lectures on the sciences connected with them, by the formation of cabinets of models, minerals, machines, materials and products, by exhibitions and premiums, by a library and by all such measures as they may judge expedient.

SEC. 4. The members of the said corporation shall consist of manufacturers, mechanics, artisans, and persons friendly to the mechanic arts, and of such stockholders in said corporation as may, by the By-Laws, be entitled to the privileges of members; and every member shall pay such sum for an annual or life subscription as the By-Laws of said corporation may require; and honorary and corresponding members may be elected at such times, and in such a way, and with such privileges as said corporation may deem expedient.

SEC. 5. The said corporation shall be managed in such way, and by such number of officers, managers and other persons as the By-Laws may prescribe, and the powers and functions of such officers, managers or other persons, the rights and duties of members, the manner of their election, and the causes which may justify their expulsion or suspension, and all other concerns of the said corporation, shall be fixed and regulated by its By-Laws, which By-Laws shall be adopted by said corporation at the first monthly meeting after the acceptance of this amended Charter, and said By-Laws shall be altered and amended only in the manner provided in said By-Laws as then adopted.

SEC. 6. So much of the Act to which this is a supplement as is inconsistent herewith is repealed.

OFFICE OF THE SECRETARY OF THE COMMONWEALTH OF PENNSYLVANIA,

April 25th, 1864.

I certify that the foregoing bill passed both branches of the Legislature, and received the signature of the Governor on this day. As witness my hand the day and the year above written.

(Signed.)

ELI SLIFER, *Secretary of the Commonwealth.*

BY-LAWS OF THE INSTITUTE

ARTICLE I.—*Stock*

SECTION 1. The Real and Personal Estates of the Institute as held upon the First day of January, One Thousand Eight Hundred and Eighty-one, shall be valued at One Hundred Thousand Dollars, and shall be represented by Ten Thousand Shares of Stock of the par value of Ten Dollars each. Said shares shall be divided into two classes, *viz.*—

First Class.—Shares not registered for use: on which no annual payment shall be charged or collected, and the holders thereof shall not have the privileges of members of the Institute, but may, if of legal age, vote at any annual election for officers and managers upon the payment of One Dollar upon each share of stock on which they may desire to vote; provided, however, such shares have been held by the same person at least three months before such election.

Shares of the First Class may be converted into shares of the Second Class at the pleasure of the owners, provided the transfer be approved by the Board of Managers; but, when once so converted, they shall always continue in the Second Class.

Second Class.—Shares registered for use: on which Twelve Dollars per annum shall be due and payable from resident members in advance on the first day of October in each year, except as hereinafter provided.

Non-resident holders of Second Class stock shall pay an annual fee of Five Dollars.

SEC. 2. The holders of Second Class stock shall be entitled to the use of the library, lectures and reading-room; and, if of legal age, to all other privileges of membership in the Institute, so long as they make the annual payment in advance; and shall, on the payment of One Dollar therefore, be entitled to a Certificate of Membership.

SEC. 3. If the annual dues for successive years remain unpaid at the expiration of two and a half years on any share of stock of the Second Class, such share shall then become forfeited to the Institute; but such forfeiture may be remitted by a unanimous vote of the Board of Managers.

SEC. 4. Stock of the Second Class may be held in trust for persons not of legal age, and shall be liable to the payment of only one-half the annual fees due upon stock of Second Class held by persons of legal age; provided, that when such minors arrive at legal age, new certificates, subject to the full annual contribution, shall issue on payment of the customary fee.

SEC. 5. Certificates for the First Class stock may be issued for any number of shares in a single certificate; but every certificate for the Second Class shall be for one share only.

SEC. 6. No share of stock in the Second Class shall be transferred until all arrearages and fines are paid, and all books and tickets returned, and the transfer approved by the Board of Managers.

SEC. 7. All certificates of stock shall be signed by the President and Secretary; shall be issued by the Controller, and shall be transferable only on the books of the Institute by the owner, or his legal representative, on the surrender of the old certificate, and of a fee of twenty-five cents for each certificate.

SEC. 8. All subscriptions to stock shall be approved by the Board of Managers before the certificate can be issued.

ARTICLE II.—*Members*

SECTION 1. Members of the Institute shall consist of those engaged or interested in scientific pursuits or in the application of science in the mechanic and industrial arts. All persons interested in the purposes and activities of the Institute, and who are willing to further them, may become members when proposed by members in good standing and elected by the Board of Managers. The membership of the Institute shall consist of the following classes of members, *vis.*, Honorary and Corresponding, Endowment, Life, Contributing, Resident, Non-resident, Student, and holders of Second-class Stock.

SEC. 2. Honorary and Corresponding members shall be nominated by the Board of Managers and shall require for their election four-fifths of the votes of the members present at any stated meeting of the Institute at which their nomination may be acted upon. They shall not be entitled to vote nor to hold office. All other members shall be elected by the Board of Managers.

SEC. 3. Endowment members shall consist of persons, firms, corporations or associations who shall make an endowment payment of Five Thousand Dollars (\$5000) to the Institute, and who, upon acceptance thereof by the Board of Managers, shall thereafter have the privilege of nominating annually to the Board of Managers for election (subject to its discretion as to any particular nominee) as Resident members of the Institute for its then current year without payment of dues that number of persons, to be determined from time to time by the Board of Managers, whose annual dues if they were paying annual Resident Membership dues would approximately equal but not exceed the then current income from such endowment payments. Such Endowment Memberships shall be perpetual, and shall be transferable by the holders thereof by will or otherwise: Provided, however, that the Board of Managers at any time may refund Five Thousand Dollars (\$5000) to the then holders of any such membership, and annul and terminate that membership.

SEC. 4. Contributing members shall consist of firms, corporations, associations or individuals who shall pay annually the sum of Three Hundred Dollars (\$300). A Contributing member shall have the right to nominate nineteen persons to the Board of Managers for election as Resident members for the year then current, subject to the discretion of the Board as to any particular nominee, and members thus elected shall pay no dues.

SEC. 5. Resident Life members, whose memberships shall not be transferable, are those members who shall pay the sum of Three Hundred Dollars (\$300) in any one year. Non-resident Life members shall be those who reside

permanently at a distance of not less than twenty-five miles from Philadelphia and who shall pay the sum of One Hundred Dollars (\$100) in any one year.

SEC. 6. Resident members shall be residents of the City of Philadelphia who have been elected to membership in the Institute and who shall pay annual dues of Fifteen Dollars.

SEC. 7. Non-resident members shall be those members who reside permanently at a distance of not less than twenty-five miles from Philadelphia and who shall pay annual dues of Five Dollars. They shall also pay an initiation fee of Five Dollars.

SEC. 8. Student members shall be over sixteen and under twenty-two years of age. They shall pay annual dues of Three Dollars if they do not receive the JOURNAL of the Institute, and Six Dollars if they do receive the JOURNAL. The term of student members shall be limited by the age of twenty-two years, after which time they shall be eligible for transfer to the other classes of membership upon the payment of the appropriate fee or dues.

SEC. 9. Privileges: All members, of whatever class, are entitled to participate in the meetings of the Institute, in the use of the Library, to receive tickets for the lectures, and to receive monthly one copy of the JOURNAL of the Institute, except that student members, and honorary and corresponding members shall not have the right to vote, nor to hold office, and student members paying the Three-dollar annual dues shall not receive the JOURNAL of the Institute.

ARTICLE III.—*Payments of Dues*

SECTION 1. The annual fees for membership shall be due and payable on the first of October in each year, in advance, but all members elected after the thirty-first of March in each year shall pay in advance for the current year one-half of the annual dues.

SEC. 2. Any member whose dues are more than three months in arrears shall be notified by the Controller. Should such dues not be paid when they become six months in arrears, the privileges of membership shall be suspended. When nine months in arrears such member shall be notified again, and if such dues become one year in arrears, the said member shall forfeit all connection with the Institute. The Board of Managers at its discretion may extend the time for payment and for the application of these penalties.

The Board of Managers may remit temporarily the annual dues of any member who, for reasons satisfactory to the Board, is unable to pay such dues; and the Board may remit the whole or part of the dues in arrears or accept in lieu thereof service or material contributed to the Institute.

SEC. 3. Every person admitted to membership in the Institute shall be considered as liable for the payment of dues until he shall have resigned, been dropped or have been relieved therefrom by the Board of Managers.

SEC. 4. Resignations of membership shall be made to the Board of Managers in writing, but need not be accepted until all dues and arrears up to date of resignation shall have been paid.

SEC. 5. The annual dues from members may be applied to the current expenses of the Institute, but all moneys received from Life and Endowment

memberships shall be added to the capital account of the Institute, and only the income therefrom shall be applied to current expenses.

ARTICLE IV.—*Election of Officers*

SECTION 1. The officers shall be a President, three Vice-presidents, a Secretary, a Treasurer, a Controller, a Librarian, and twenty-four Managers.

SEC. 2. At the annual meeting of the Institute the President and the Treasurer shall be elected to serve one year, and one Vice-president, and eight Managers, shall be elected to serve for three years; provided, that the officers now elected or who may hereafter be elected shall continue to serve until their successors be elected.

SEC. 3. All elections for officers of the Institute shall be by letter ballot, and no vote may be cast by proxy.

SEC. 4. Nominations for President, Vice-president, Treasurer and Managers shall be made in writing at the stated meeting in the month of December. Each nomination paper must be signed by at least two members, who shall certify that the candidate will serve if elected. After the nominations are closed, the President shall appoint three members, who are neither officers nor nominees, to act as tellers of the election. The list of nominees shall be posted at the Institute and incorporated (with directions for voting) in a ballot to be sent to each member by the Secretary at least one week before the date of the election. Each ballot shall be accompanied by a return envelope addressed "To the Tellers of Election," and provided with a space for the signature of the member voting.

SEC. 5. On the date of the annual meeting, and at an hour previously designated by their chairman, the tellers shall meet at the Institute and shall count all legal votes that have been received by mail or placed in the ballot box before 8 o'clock P.M.; and when the count is completed they shall report to the annual meeting of the Institute the total number of ballots cast, together with the number of votes received by each candidate. Thereupon the presiding officer shall announce the names of the candidates who received the plurality of votes for each office, and shall declare them elected officers of the Institute for the ensuing terms.

ARTICLE V.—*Duties of Officers*

SECTION 1. The President shall be the executive head of the Institute and as such shall have the general direction and supervision of all the affairs of the Institute. He shall preside at all meetings of the Institute and of the Board of Managers and shall be *ex officio* a member of all committees of the Institute and of the Board.

SEC. 2. The Vice-presidents shall exercise the duties of the President in his absence in the order of their seniority in office.

SEC. 3. The Secretary of the Institute shall be appointed by the Board of Managers and shall have charge and supervision, subject to the Board of Managers, of all the scientific activities of the Institute, other than those connected with the Bartol Research Foundation, its publications, museum and equipment. He shall keep the minutes of all meetings of the Institute and

of the Board of Managers, and shall perform all the duties usually pertaining to the office of Secretary. He shall be *ex officio* a member of the Board of Managers, and of all standing committees of the Institute and of the Committee on Publications of the Board of Managers.

SEC. 4. The Treasurer shall receive all funds, payable to the Board of Managers, and all moneys collected for the Institute. He shall deposit all moneys received, in the name of the Institute, in such banks or trust companies as the Board of Managers may direct. He shall make no payments without the authority of the Board of Managers. He shall see that there are kept accurate accounts of the income and disbursements of the Institute, shall report current receipts and payments at each stated meeting of the Board of Managers, and shall make a detailed statement of the financial condition of the Institute at its annual meeting. He shall give bond to an amount, and with such surety, as the Board of Managers shall determine. In case of a vacancy in the office of Treasurer, it shall be the duty of the Board of Managers to appoint a person to perform the duties of the position until the next annual meeting.

SEC. 5. The Board of Managers shall appoint the Controller, who shall keep all the accounts of the Institute, shall collect all moneys due the Institute and deposit them in the Treasurer's account, and shall approve all expenditures. He shall act with the Committee on Finance in the preparation of the annual budget. He shall act as the business agent of the publications of the Institute. He shall have charge of the buildings of the Institute and shall be responsible for their maintenance, repairs and insurance. He shall perform such other duties as may be prescribed by the Board of Managers.

SEC. 6. The Board of Managers shall appoint a Librarian, who shall have charge of the library and reading-room of the Institute, and who shall perform the duties usually pertaining to such office, subject to instructions from the Board.

ARTICLE VI.—*Board of Managers*

SECTION 1. The Board of Managers shall have entire charge and control of the affairs of the Institute, and shall consist of twenty-four members elected as provided in Article IV. The President, the Vice-presidents, the Secretary, the Treasurer, and the Chairman of the Committee on Science and the Arts shall be *ex officio* members.

SEC. 2. They shall present, through the President, at the annual meeting of the Institute, a report of their proceedings and of the condition of the affairs of the Institute.

SEC. 3. They shall hold stated meetings once in each month except in July and August. The chairman shall be the President of the Institute. Seven of their members shall constitute a quorum.

SEC. 4. Special meetings may be called by the President at his discretion, and shall be called by him on written request of the Executive Committee or of any seven members of the Board. In case of his absence or refusal to act, such special meeting shall be called by the Secretary.

SEC. 5. Members who have not attended five regular meetings in the twelve months prior to the stated meeting of the Institute in December, shall be

reported thereat as having resigned, unless it be unanimously voted by the Board at that meeting, that such member has been absent for sufficient reason.

SEC. 6. All vacancies on the Board of Managers shall be filled by the Board until the next annual meeting of the Institute.

ARTICLE VII.—*Committees of the Board of Managers*

The following standing committees of the Board of Managers, each consisting of five members, shall be appointed by the President and approved by the Board:

1. Executive.
2. On Endowment.
3. On Finance.
4. On Membership.
5. On Publications.
6. On Bartol Research Foundation.

The Executive Committee shall make to the Board such recommendation as it may deem advisable, but in the absence of specific delegation of authority, it shall have no power to act on behalf of the Board.

The Committee on Finance shall have charge of all securities and investment funds belonging to the Institute and shall invest and reinvest the same and pay the income therefrom to the Treasurer of the Institute. The Committee may, with the approval of the Board of Managers, appoint a trust company of the City of Philadelphia to act as fiscal agent under the direction of the Committee. All purchases or sales of securities shall be reported monthly to the Board.

The Bartol Research Foundation Committee shall have charge of the provision, maintenance and operation of all laboratories and equipment concerning the Bartol Research Foundation. It shall engage the professional staff subject to the approval of the Board of Managers of the Institute and shall also engage and direct the operators and helpers employed in the work of the Foundation. It shall be composed of not more than twelve members, as follows: Five members of the Board of Managers, appointed by the President and approved by the Board; the President; the Director of the Bartol Research Laboratories; five members appointed by the President with the approval of the Board from the membership of the Institute not members of the Board.

The Director of the Bartol Research Laboratories shall report to the Bartol Research Foundation Committee. All other employees of the Foundation shall report to the Director. The Committee shall have full power to carry out the purposes of the Foundation. It shall make a report of its operation to the Board of Managers at each stated meeting.

ARTICLE VIII.—*Audits*

The accounts of the Treasurer and of the Fiscal Agent shall be audited at least once a year by certified public accountants, who shall report to the Board of Managers.

ARTICLE IX.—*Committees of the Institute*

SECTION 1. There shall be the following standing committees of the Institute:

1. On Library.
2. On Meetings.
3. On Museum.
4. On Science and the Arts.

SEC. 2. The Committees on Library, Meetings and Museum shall consist of ten members each, appointed by the President at the first stated meeting after the annual election, to serve one year.

SEC. 3. The Committee on Library shall purchase books and other publications of a kind and character suitable to and consonant with the purpose of the Institute's library.

SEC. 4. The Committee on Meetings shall act with the Secretary of the Institute to secure for presentation before the Institute papers dealing authoritatively with subjects of import in the fields of physical science and engineering.

SEC. 5. The Committee on Science and the Arts shall consist of sixty members who shall serve three years. Twenty shall be elected each year by the Board of Managers at the first meeting after the annual election. The Committee shall investigate current discoveries, inventions and other achievements of workers in the physical sciences and their application in the mechanic and industrial arts with a view of affording such recognitions as lie within the power of the Institute to bestow.

SEC. 6. These committees shall organize and adopt rules and regulations suitable to their several activities, subject to the approval of the Board.

ARTICLE X.—*Meetings*

SECTION 1. The Institute shall hold stated meetings on the third Wednesday of each month, except in June, July, August, and September. That on the third Wednesday in January of each year shall be the annual meeting.

SEC. 2. Special meetings shall be called by order of the President, upon request of the Board of Managers, or the written application of twelve members of the Institute. Fifteen members shall constitute a quorum.

ARTICLE XI.—*Amendments*

These By-Laws may be altered or amended at any stated meeting of the members of the Institute, provided notice in writing, signed by two members, of the proposed alteration or amendment, shall be given to the Board of Managers two months prior to the said meeting, except that amendments to Article I, relating to capital stock, must be ratified subsequently by a majority of the stock represented at a meeting specially called for this purpose.

BY-LAWS OF THE BOARD OF MANAGERS

Organization Meeting.

A meeting for the purpose of organizing, electing members of the Committee on Science and the Arts, appointing a Secretary, an Assistant Secretary and Librarian, a Controller and Standing Committees, shall be held on the fourth Wednesday in January, at 4.15 o'clock, P.M.

Stated Meetings.

Stated meetings shall be held on the second Wednesday of each month at 12.30 o'clock, P.M.

Order of Business.

1. Calling the roll.
2. Reading the minutes of the previous meeting.
3. Report from Treasurer.

4. Reports from Standing Committees of the Board of Managers:
 - (a) Finance.
 - (b) Membership.
 - (c) Publications.
 - (d) Bartol Research Foundation.
 - (e) Endowment.
 - (f) Executive.
5. Reports from Standing Committees of the Institute:
 - (a) Library.
 - (b) Meetings.
 - (c) Museum.
 - (d) Science and the Arts.
6. Reports from Special Committees.
7. Deferred Business.
8. New Business.

Reports.

All committees of the Board shall keep regular minutes of their proceedings and shall report monthly to the Board; they shall also report, through the Committee on Finance, to the stated meeting of the Board in September, an estimate of moneys they require for the service of the ensuing year.

SEC. 2. The Committees on Library, Meetings and Museum shall consist of ten members each, appointed by the President at the first stated meeting after the annual election, to serve one year.

SEC. 3. The Committee on Library shall purchase books and other publications of a kind and character suitable to and consonant with the purpose of the Institute's library.

SEC. 4. The Committee on Meetings shall act with the Secretary of the Institute to secure for presentation before the Institute papers dealing authoritatively with subjects of import in the fields of physical science and engineering.

SEC. 5. The Committee on Science and the Arts shall consist of sixty members who shall serve three years. Twenty shall be elected each year by the Board of Managers at the first meeting after the annual election. The Committee shall investigate current discoveries, inventions and other achievements of workers in the physical sciences and their application in the mechanic and industrial arts with a view of affording such recognitions as lie within the power of the Institute to bestow.

SEC. 6. These committees shall organize and adopt rules and regulations suitable to their several activities, subject to the approval of the Board.

ARTICLE X.—*Meetings*

SECTION 1. The Institute shall hold stated meetings on the third Wednesday of each month, except in June, July, August, and September. That on the third Wednesday in January of each year shall be the annual meeting.

SEC. 2. Special meetings shall be called by order of the President, upon request of the Board of Managers, or the written application of twelve members of the Institute. Fifteen members shall constitute a quorum.

ARTICLE XI.—*Amendments*

These By-Laws may be altered or amended at any stated meeting of the members of the Institute, provided notice in writing, signed by two members, of the proposed alteration or amendment, shall be given to the Board of Managers two months prior to the said meeting, except that amendments to Article I, relating to capital stock, must be ratified subsequently by a majority of the stock represented at a meeting specially called for this purpose.

BY-LAWS OF THE BOARD OF MANAGERS

Organization Meeting.

A meeting for the purpose of organizing, electing members of the Committee on Science and the Arts, appointing a Secretary, an Assistant Secretary and Librarian, a Controller and Standing Committees, shall be held on the fourth Wednesday in January, at 4.15 o'clock, P.M.

Stated Meetings.

Stated meetings shall be held on the second Wednesday of each month at 12.30 o'clock, P.M.

Order of Business.

1. Calling the roll.
2. Reading the minutes of the previous meeting.
3. Report from Treasurer.

4. Reports from Standing Committees of the Board of Managers:
 - (a) Finance.
 - (b) Membership.
 - (c) Publications.
 - (d) Bartol Research Foundation.
 - (e) Endowment.
 - (f) Executive.
5. Reports from Standing Committees of the Institute:
 - (a) Library.
 - (b) Meetings.
 - (c) Museum.
 - (d) Science and the Arts.
6. Reports from Special Committees.
7. Deferred Business.
8. New Business.

Reports.

All committees of the Board shall keep regular minutes of their proceedings and shall report monthly to the Board; they shall also report, through the Committee on Finance, to the stated meeting of the Board in September, an estimate of moneys they require for the service of the ensuing year.

AWARDS BY THE INSTITUTE

The following awards are made by The Franklin Institute:

The Franklin Medal.
The Elliott Cresson Medal.
The Howard N. Potts Medal.
The Louis Edward Levy Medal.
The George R. Henderson Medal.
The Walton Clark Medal.
The John Price Wetherill Medal.
The Edward Longstreth Medal.
The Certificate of Merit.
The Boyden Premium.

The making or recommending of these awards is, by resolution of the Institute, entrusted to its Committee on Science and the Arts, a Committee consisting of sixty members of the Institute. This Committee recommends to the Institute the award of the Franklin Medal to distinguished scientists or technologists; and investigates, upon application, and reports on any worthy invention, discovery or process, recommending the award, according to merit, of the Elliott Cresson Medal, the Howard N. Potts Medal, the Louis Edward Levy Medal, the George R. Henderson Medal, the Walton Clark Medal, the John Price Wetherill Medal, the Edward Longstreth Medal, or the Certificate of Merit.

The Franklin Medal (Gold Medal and Certificate).—This medal is awarded annually from the Franklin Medal Fund, founded January 1, 1914, by Samuel Insull, Esq., to those workers in physical science or technology, without regard to country, whose efforts, in the opinion of the Institute, acting through its Committee on Science and the Arts, have done most to advance a knowledge of physical science or its applications.

The Elliott Cresson Medal (Gold Medal and Certificate).—This medal is awarded for discovery or original research, adding to the sum of human knowledge, irrespective of commercial value; leading and practical utilizations of discovery; and invention, methods of products embodying substantial elements of leadership in their respective classes, or unusual skill or perfection in workmanship.

The Howard N. Potts Medal (Gold Medal and Certificate).—This medal is awarded for distinguished work in science or the arts; important development of previous basic discoveries; inventions or products of superior excellence or utilizing important principles.

The Louis E. Levy Medal (Gold Medal and Certificate).—This medal is awarded to the author of a paper of especial merit, published in the JOURNAL OF THE FRANKLIN INSTITUTE, preference being given to one describing the author's experimental and theoretical researches in a subject of fundamental importance.

The George R. Henderson Medal (Gold Medal and Certificate).—This



THE ELLIOTT CRESSON
MEDAL

Founded 1848



THE FRANKLIN MEDAL (OBVERSE AND REVERSE)

Founded by Samuel Insull, 1914



THE HOWARD N. POTTS
MEDAL

Founded 1906

17

medal is awarded for meritorious inventions or discoveries in the field of railway engineering.

The Walton Clark Medal (Gold Medal).—This medal is awarded to the "author of the most notable advance in knowledge or improvement in apparatus, or in method concerning the science or the art of gas manufacture or distribution or utilization in the production of illumination, or of heat, or of power."

The John Price Wetherill Medal (Silver Medal and Certificate).—This medal is awarded for discovery or invention in the physical sciences, or for new and important combinations of principles or methods already known.

The Edward Longstreth Medal (Silver Medal and Certificate).—This medal, with a money premium when the accumulated interest of the fund permits, is awarded for meritorious work in science or the arts. In the event of an accumulation of the fund for medals beyond the sum of one hundred dollars, it is competent for the Committee on Science and the Arts to offer from such surplus a money premium for some special work on any mechanical or scientific subject that is considered of sufficient importance.

The Certificate of Merit.—A Certificate of Merit is awarded to persons adjudged worthy thereof for their inventions, discoveries or productions.

The Boyden Premium (Premium of \$1000).—To any resident of North America who shall determine by experiment whether all rays of light and other physical rays are or are not transmitted with the same velocity.

HISTORY OF THE MEDALS

The Franklin Medal.—Samuel Insull, Esq., of Chicago, Illinois, writing under date of December 23, 1913, to the Board of Managers, stated that he had been informed it would be a source of gratification to them if the Institute had available, in addition to such medals already in its gifts, a medal to be known as The Franklin Medal, and to be awarded from time to time in recognition of the total contributions of individuals to science or to the applications of physical science to industry, rather than in recognition of any single invention or discovery, however important. He agreed to provide for the founding of this medal under the following general conditions:

1. That an amount not exceeding one thousand dollars should be furnished by him for procuring appropriate designs and dies for the medal and diploma.

2. That the medal should possess distinct artistic merit, and have on one side a medallion of Benjamin Franklin done from the Thomas Sully portrait in the possession of the Institute.

3. That the medal should be of gold and have an intrinsic value of about seventy-five dollars.

4. That the sum of five thousand dollars should be provided by him to be held in trust in perpetuity to be a foundation for this medal, and to be known as The Franklin Medal Fund (Founded January 1, 1914, by Samuel Insull, Esq.).

5. That the interest of this fund should be used from time to time in awarding The Franklin Medal to those workers in physical science or technology, without regard to country, whose efforts

medal is awarded for meritorious inventions or discoveries in the field of railway engineering.

The Walton Clark Medal (Gold Medal).—This medal is awarded to the "author of the most notable advance in knowledge or improvement in apparatus, or in method concerning the science or the art of gas manufacture or distribution or utilization in the production of illumination, or of heat, or of power."

The John Price Wetherill Medal (Silver Medal and Certificate).—This medal is awarded for discovery or invention in the physical sciences, or for new and important combinations of principles or methods already known.

The Edward Longstreth Medal (Silver Medal and Certificate).—This medal, with a money premium when the accumulated interest of the fund permits, is awarded for meritorious work in science or the arts. In the event of an accumulation of the fund for medals beyond the sum of one hundred dollars, it is competent for the Committee on Science and the Arts to offer from such surplus a money premium for some special work on any mechanical or scientific subject that is considered of sufficient importance.

The Certificate of Merit.—A Certificate of Merit is awarded to persons adjudged worthy thereof for their inventions, discoveries or productions.

The Boyden Premium (Premium of \$1000).—To any resident of North America who shall determine by experiment whether all rays of light and other physical rays are or are not transmitted with the same velocity.

HISTORY OF THE MEDALS

The Franklin Medal.—Samuel Insull, Esq., of Chicago, Illinois, writing under date of December 23, 1913, to the Board of Managers, stated that he had been informed it would be a source of gratification to them if the Institute had available, in addition to such medals already in its gifts, a medal to be known as The Franklin Medal, and to be awarded from time to time in recognition of the total contributions of individuals to science or to the applications of physical science to industry, rather than in recognition of any single invention or discovery, however important. He agreed to provide for the founding of this medal under the following general conditions:

1. That an amount not exceeding one thousand dollars should be furnished by him for procuring appropriate designs and dies for the medal and diploma.

2. That the medal should possess distinct artistic merit, and have on one side a medallion of Benjamin Franklin done from the Thomas Sully portrait in the possession of the Institute.

3. That the medal should be of gold and have an intrinsic value of about seventy-five dollars.

4. That the sum of five thousand dollars should be provided by him to be held in trust in perpetuity to be a foundation for this medal, and to be known as The Franklin Medal Fund (Founded January 1, 1914, by Samuel Insull, Esq.).

5. That the interest of this fund should be used from time to time in awarding The Franklin Medal to those workers in physical science or technology, without regard to country, whose efforts

have, in the judgment of the Institute, done most to advance a knowledge of physical science or its applications.

6. That any excess of income from this fund, beyond such average annual sum as might be deemed necessary by the Institute for the number of medals it is considered best to award, might be used for premiums to accompany the medals.

The Elliott Cresson Medal.—Under date of February 18, 1848, Elliott Cresson, Esq., of Philadelphia, Pennsylvania, conveyed to the Trustees for The Franklin Institute one thousand dollars of the six per cent. convertible loan of the President, Managers and Company of the Schuylkill Navigation Company—to hold the said sum and the interest to accrue thereon, for the following uses and purposes:

1. The Trustees to keep the principal invested as it now (1848) is until it is reimbursed by the said Company, and immediately after such reimbursement to reinvest the said principal of one thousand dollars in such securities, bearing interest, as may by law be designated for the investment of trust funds. And from time to time, as the said principal sum may be reimbursed, to reinvest the same in like manner.

2. To cause suitable dies to be prepared for striking the gold medal out of the first sufficient moneys received for interest on the said sum of one thousand dollars, the dies to bear the following devices and inscription: The obverse—a medallion likeness of the said Elliott Cresson with inscription around the margin, "Elliott Cresson Medal, A.D. 1848." Reverse—around the margin, "Awarded by The Franklin Institute of Pennsylvania." The centre to be filled by engraving the name of the party to whom awarded and the year in which the award is made.

3. After the said dies have been prepared, and paid for out of the money received for interest, the said Trustees to cause to be struck, from time to time, such number of gold medals as the interest received will pay for, and to deliver the same to the Treasurer of The Franklin Institute, to be by him transmitted to such persons or parties as the said Franklin Institute may have awarded the same; the said awards, however, to be in all instances made either for some discovery in the arts and sciences, or for the invention or improvement of some useful machine, or for some new process or combination of materials in manufactures, or for ingenuity, skill or perfection in workmanship.

The Howard N. Potts Medal.—Howard N. Potts, Esq., of Philadelphia, Pennsylvania, died July 24, 1906, leaving a will in which he provided for the establishment of this medal as follows:

"I give and bequeath to The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts and its successors, the sum of one thousand dollars, without deduction for taxes or charges; in trust to invest the same and apply the income thereof or such part or portion of it as may be adequate



THE LOUIS EDWARD LEVY
MEDAL

Founded by the family of Louis
Edward Levy, 1923



THE GEORGE R. HENDERSON
MEDAL

Founded by Mrs. Virginia P. C.
Henderson, 1924



THE WALTON CLARK MEDAL

Founded 1926



THE JOHN PRICE WETHERILL
MEDAL

Founded by the family of
John Price Wetherill, 1925



THE EDWARD LONGSTRETH
MEDAL

Founded 1890

have, in the judgment of the Institute, done most to advance a knowledge of physical science or its applications.

6. That any excess of income from this fund, beyond such average annual sum as might be deemed necessary by the Institute for the number of medals it is considered best to award, might be used for premiums to accompany the medals.

The Elliott Cresson Medal.—Under date of February 18, 1848, Elliott Cresson, Esq., of Philadelphia, Pennsylvania, conveyed to the Trustees for The Franklin Institute one thousand dollars of the six per cent. convertible loan of the President, Managers and Company of the Schuylkill Navigation Company—to hold the said sum and the interest to accrue thereon, for the following uses and purposes:

1. The Trustees to keep the principal invested as it now (1848) is until it is reimbursed by the said Company, and immediately after such reimbursement to reinvest the said principal of one thousand dollars in such securities, bearing interest, as may by law be designated for the investment of trust funds. And from time to time, as the said principal sum may be reimbursed, to reinvest the same in like manner.

2. To cause suitable dies to be prepared for striking the gold medal out of the first sufficient moneys received for interest on the said sum of one thousand dollars, the dies to bear the following devices and inscription: The obverse—a medallion likeness of the said Elliott Cresson with inscription around the margin, "Elliott Cresson Medal, A.D. 1848." Reverse—around the margin, "Awarded by The Franklin Institute of Pennsylvania." The centre to be filled by engraving the name of the party to whom awarded and the year in which the award is made.

3. After the said dies have been prepared, and paid for out of the money received for interest, the said Trustees to cause to be struck, from time to time, such number of gold medals as the interest received will pay for, and to deliver the same to the Treasurer of The Franklin Institute, to be by him transmitted to such persons or parties as the said Franklin Institute may have awarded the same; the said awards, however, to be in all instances made either for some discovery in the arts and sciences, or for the invention or improvement of some useful machine, or for some new process or combination of materials in manufactures, or for ingenuity, skill or perfection in workmanship.

The Howard N. Potts Medal.—Howard N. Potts, Esq., of Philadelphia, Pennsylvania, died July 24, 1906, leaving a will in which he provided for the establishment of this medal as follows:

"I give and bequeath to The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts and its successors, the sum of one thousand dollars, without deduction for taxes or charges; in trust to invest the same and apply the income thereof or such part or portion of it as may be adequate



THE LOUIS EDWARD LEVY
MEDAL

Founded by the family of Louis
Edward Levy, 1923



THE GEORGE R. HENDERSON
MEDAL

Founded by Mrs. Virginia P. C.
Henderson, 1924



THE WALTON CLARK MEDAL

Founded 1926



THE JOHN PRICE WETHERILL
MEDAL

Founded by the family of
John Price Wetherill, 1925



THE EDWARD LONGSTRETH
MEDAL

Founded 1890

for the purpose, from time to time, to the purchase of a gold medal, to be awarded in the name of the said Franklin Institute for distinguished work in science or the mechanic arts."

The Louis E. Levy Medal.—Under date of December 12, 1923, the following letter was received from Mr. Lionel F. Levy, a member of the Committee on Science and the Arts:

"To The Board of Managers of

"The Franklin Institute of The State of Pennsylvania,

"Philadelphia, Pennsylvania.

"Gentlemen:

"Understanding from my associates on your Committee on Science and the Arts that a feeling obtains among them that the purposes of the Institute would be aided should there be available to the Institute a medal for the recognition of contributions to the JOURNAL, I take the liberty of addressing you to say that my brother, Mr. Howard S. Levy, my sister, Miss Hortense Levy, and I will be glad to found a medal in memory of our Father, the late Louis E. Levy, under the following general conditions:

"First: That we furnish a sum not exceeding five hundred (\$500) dollars to cover the cost of an appropriate design and the necessary dies and diplomas.

"Second: That the medal be of gold and have an intrinsic value of about sixty (\$60) dollars.

"Third: That we furnish the sum of two thousand (\$2000) dollars to be known as the Louis E. Levy Medal Fund.

"Fourth: That the interest on this fund shall be used from time to time in awarding the Louis E. Levy Medal for papers contributed to the JOURNAL of the Institute, descriptive of the author's researches in physical science or of his engineering achievements, which have added largely to the sum of knowledge or aided greatly the well-being of mankind.

"Fifth: That any excess of income from this fund beyond that necessary for the number of medals which the Institute may think best to award shall be added to the Louis E. Levy Library Fund.

"I am,

"Very truly yours,

"(Signed) LIONEL F. LEVY."

This matter was brought to the attention of the Board of Managers at their meeting on December 12, 1923, and the proposed fund was accepted.

The George R. Henderson Medal.—Under date of September 24, 1924, the following communication was presented to the Acting Secretary:

"I herewith present to The Franklin Institute the sum of two thousand five hundred dollars (\$2500). Of this amount a sufficient sum is to be used for the cost of preparing dies for a medal to be known as the George R. Henderson Gold Medal which is to be awarded by the Institute on the recommendation of the Committee on Science and the Arts for meritorious inventions or discoveries in the field of railway engineering. The remaining amount is to constitute a fund in trust, the net income from which, or such portion thereof as may be needed, shall be used for the purchase of the said gold medal as required.



for the purpose, from time to time, to the purchase of a gold medal, to be awarded in the name of the said Franklin Institute for distinguished work in science or the mechanic arts."

The Louis E. Levy Medal.—Under date of December 12, 1923, the following letter was received from Mr. Lionel F. Levy, a member of the Committee on Science and the Arts:

"To The Board of Managers of

"The Franklin Institute of The State of Pennsylvania,
"Philadelphia, Pennsylvania.

"Gentlemen:

"Understanding from my associates on your Committee on Science and the Arts that a feeling obtains among them that the purposes of the Institute would be aided should there be available to the Institute a medal for the recognition of contributions to the JOURNAL, I take the liberty of addressing you to say that my brother, Mr. Howard S. Levy, my sister, Miss Hortense Levy, and I will be glad to found a medal in memory of our Father, the late Louis E. Levy, under the following general conditions:

"First: That we furnish a sum not exceeding five hundred (\$500) dollars to cover the cost of an appropriate design and the necessary dies and diplomas.

"Second: That the medal be of gold and have an intrinsic value of about sixty (\$60) dollars.

"Third: That we furnish the sum of two thousand (\$2000) dollars to be known as the Louis E. Levy Medal Fund.

"Fourth: That the interest on this fund shall be used from time to time in awarding the Louis E. Levy Medal for papers contributed to the JOURNAL of the Institute, descriptive of the author's researches in physical science or of his engineering achievements, which have added largely to the sum of knowledge or aided greatly the well-being of mankind.

"Fifth: That any excess of income from this fund beyond that necessary for the number of medals which the Institute may think best to award shall be added to the Louis E. Levy Library Fund.

"I am,

"Very truly yours,

"(Signed) LIONEL F. LEVY."

This matter was brought to the attention of the Board of Managers at their meeting on December 12, 1923, and the proposed fund was accepted.

The George R. Henderson Medal.—Under date of September 24, 1924, the following communication was presented to the Acting Secretary:

"I herewith present to The Franklin Institute the sum of two thousand five hundred dollars (\$2500). Of this amount a sufficient sum is to be used for the cost of preparing dies for a medal to be known as the George R. Henderson Gold Medal which is to be awarded by the Institute on the recommendation of the Committee on Science and the Arts for meritorious inventions or discoveries in the field of railway engineering. The remaining amount is to constitute a fund in trust, the net income from which, or such portion thereof as may be needed, shall be used for the purchase of the said gold medal as required.

"Any accumulation after providing the medals shall, after each period of five years, be added to the trust fund, and if this fund increases to double the original amount, one-half the net income may be used to provide the Henderson Medal for inventions in other fields than railway engineering.

"(Signed) VIRGINIA P. C. HENDERSON."

This was presented to the Board of Managers for consideration at their meeting on October 8, 1924, and was duly accepted.

The Walton Clark Medal.—On November 30, 1926, the United Gas Improvement Company of Philadelphia presented to The Franklin Institute a sufficient fund to permit of the award, not more frequently than once a year, of a gold medal, to be known as the Walton Clark Medal, "to the author of the most notable advance in knowledge, or improvement in apparatus, or in method, concerning the science or the art of Gas Manufacture, or distribution or utilization in the production of illumination or of heat, or of power." The obverse of the medal bears a profile relief of Dr. Walton Clark, and is inscribed around the margin, "The Walton Clark Medal." The reverse bears the legend "Awarded by The Franklin Institute to _____ for original and notable work in the gas industry."

The donors of the Medal generously agreed to the following condition: "If, in the opinion of the Institute, in any year there is no basis for award, it will be agreeable that the income shall be used for the acquisition of books covering the subjects of manufacturing gas, to be placed in an alcove, or other suitable place, properly marked with reference to Mr. Clark."

The John Price Wetherill Medal.—On April 3, 1917, the family of the late John Price Wetherill gave to The Franklin Institute a certain sum as the first contribution toward the establishment of a Fund for the promotion of research, to be known as "The John Price Wetherill Memorial Research Fund."

On June 10, 1925, the Board of Managers of The Franklin Institute, in accordance with the desires of the family of Mr. Wetherill, voted to set aside as much of this Fund as might be necessary, for the design and production of a silver medal, to be known as "The John Price Wetherill Medal," and to be awarded for discovery or invention in Physical Sciences, or for new and important combinations of principles or methods already known.

The obverse of the medal bears a profile relief of Mr. Wetherill and is inscribed around the margin—"The John Price Wetherill Medal 1925."

The reverse bears the legend: "Awarded by The Franklin Institute to _____ for discovery, invention, or development in the physical sciences."

The Edward Longstreth Medal.—In the month of May, 1890, Edward Longstreth, Esq., of Philadelphia, Pennsylvania, retired member of The Baldwin Locomotive Works, deposited with The Franklin Institute in trust, a registered bond of the Baltimore Traction Company for the sum of one thousand dollars, for the founding and perpetuation of the Edward Longstreth Medal of Merit; the interest accruing from said principal sum to be used in procuring and awarding said medals for the encouragement of invention, and in recognition of meritorious work in science and the industrial arts; the said awards to be made by The Franklin Institute through its Committee on Science and the Arts, under such rules as said Committee may adopt.

This donor further presented to The Franklin Institute twelve silver medals and the die therefor designed and executed under the direction of a committee of the Institute with his approval.

On May 14, 1890, the Board of Managers of The Franklin Institute, by resolution, accepted on behalf of the Institute the gifts of the donor, and on September 17, 1890, the Institute, by resolution following, confirmed the acceptance:

"Resolved, That the Institute hereby confirms the action of the Board of Managers in accepting the gift of foundation of the Edward Longstreth Medal of Merit, and in expressing its grateful acknowledgments for the gift.

"Resolved, That the grant of the Edward Longstreth Medal, in accordance with the wishes of the donor, be entrusted to the Committee on Science and the Arts, subject to such conditions as the said Committee, with the approval of the Institute, may propose."

The obverse of the medal bears the effigy of the donor, and is inscribed around the margin, "The Edward Longstreth Medal of Merit, Founded 1890." On the reverse is inscribed around the margin, "Awarded by The Franklin Institute," and in the centre is engraved the name of the recipient with the date and object of award.

On March 19, 1913, Charles Longstreth, son of the above-named Edward Longstreth, deposited with The Franklin Institute the further sum of one thousand dollars to be added to the original fund to be kept with it in trust in perpetuity, the interest to be used as is the interest of the original fund.

The Certificate of Merit.—At the stated meeting of the Institute, held on June 21, 1882, the following resolution was adopted:

"Resolved, That the Committee on Science and the Arts of The Franklin Institute is hereby authorized to award, and issue to persons by said Committee adjudged worthy, a Certificate of Merit for their inventions, discoveries or productions, which certificate shall read as follows:

"The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, awards to _____ this Certificate of Merit. This award is made pursuant to the recommendation of the Committee on Science and the Arts.

"Report No. _____ Approved, _____ 19 _____

"_____ President.

"[SEAL] _____ Secretary.

"Chairman of the Committee on Science and the Arts."

The Boyden Premium.—On March 23, 1859, Uriah A. Boyden, Esq., of Boston, Massachusetts, deposited with The Franklin Institute the sum of one thousand dollars to be awarded as a premium to any resident of North America who shall determine by experiment whether all rays of light, and other physical rays, are or are not transmitted with the same velocity.

The problem has been more specifically defined by the Board of Managers, as follows:

"Whether or not all rays in the spectrum known at the time the offer was made, namely, March 23, 1859, and comprised between the lowest frequency known thermal rays in the infra-red, and the highest frequency known rays in the ultra-violet, which in the opinion of the Committee lie between the approximate frequencies of 2×10^{14} double vibrations per second in the infra-red and 8×10^{14} in the ultra-violet, travel through free space with the same velocity."

An award, made during the year 1907, covered the solution of the problem so far as the transmission of the visible and ultra-violet rays is concerned. It has been directed by the Board of Managers that the balance of the fund be retained, to be awarded to such person as shall demonstrate whether or not the infra-red rays are or are not transmitted with the same velocity as the other rays.

REGULATIONS OF THE COMMITTEE ON SCIENCE AND THE ARTS

ARTICLE I.—*Investigations*

SECTION 1. The Committee shall investigate, by sub-committee or otherwise, any subject referred to it by the Institute; and upon a majority vote of the members present at any stated meeting, it may investigate any subject presented on motion of a member or by application as herein provided.

SEC. 2. Secret processes or compounds will not be considered by the Committee; nor will the treatment of materials by any substance be considered, unless the composition used and the method of treatment are fully disclosed.

SEC. 3. A request or a recommendation for the investigation of a subject shall be made in writing addressed to the Secretary who will submit it with full detailed information to the Sub-committee on New Subjects and Preliminary Examination. If this Sub-committee recommends it as a suitable subject for investigation to the Committee on Science and the Arts, and if this recommendation is adopted by the General Committee, the Secretary shall notify the applicant accordingly and furnish an application blank substantially like the form appended.

SEC. 4. It shall not be competent for any member of the Committee on Science and the Arts to be an applicant for investigation unless the subject for investigation be referred to the Committee by a vote of the Institute.

ARTICLE II.—*Meetings of the Committee*

SECTION 1. The Committee shall hold stated meetings at 8 o'clock P.M. on the first Wednesday of each month, excepting July, August and September.

SEC. 2. Special meetings may be called by the Chairman, and shall be called by him upon the written request of five members of the Committee.

SEC. 3. At all meetings of the Committee nine members shall constitute a quorum for transacting general business, but for final action upon a report conferring or recommending an award or for amending the rules of the Committee, a quorum shall consist of not less than fifteen members.

SEC. 4. At its stated meetings the Committee shall proceed in the following

Order of Business:

1. Calling the roll.
2. Reading of the minutes of preceding meeting.
3. Approval of bills.
4. Reading of correspondence.
5. Report of sub-committee on new subjects and preliminary examination.
6. Reports of standing and special sub-committees.
7. Consideration of reports for final action.

8. Reports of sub-committees on investigation, first reading.
9. Deferred business.
10. New business.
11. Adjournment.

ARTICLE III.—*Chairman*

SECTION 1. A Special Committee for nominating a Chairman for the ensuing year, consisting of three recent past Chairmen, shall be appointed at the January Meeting of the Committee, this special committee to report its nomination of a candidate at the February meeting. At this meeting, additional nominations may be made by any member of the Committee on Science and the Arts. The election shall be by ballot at the same meeting, when the person receiving the highest number of votes shall be declared elected. He shall immediately assume office and shall perform his duties until his successor is installed. He shall not be eligible for election in two successive terms.

SEC. 2. The Chairman shall appoint the members of all sub-committees unless otherwise ordered, and may serve *ex officio* on all sub-committees except those charged with investigations.

SEC. 3. The election of a member as Chairman shall be held to vacate his membership of any and all sub-committees of investigation on which he may be serving, except if he has the report of such Committee prepared or in preparation, in which case he shall complete his work, but when such report is presented for consideration, he shall call on another member to preside while the subject is under discussion.

SEC. 4. The Chairman shall submit to the stated meetings of the Board of Managers in October, December, February, April and June of each year, a report of the number of investigations pending before the Committee, the number disposed of since the last report, with the action taken or award made in each case, and the number and nature of new investigations undertaken since the last report, and such other information as to the work of the Committee as the Board of Managers may require. He shall also report to the stated meetings of the Institute such recent action of the Committee as he may deem of interest.

ARTICLE IV.—*Standing Sub-committees*

SECTION 1. There shall be appointed each February by the Chairman a sub-committee of not less than five members of the Committee, to be styled the "Sub-committee on New Subjects and Preliminary Examination." The duties of this sub-committee shall be to keep a general observation of progress made in science and the arts and to report to the Committee subjects adjudged worthy of investigation; to coöperate with the Secretary in keeping the work of the Committee properly before the public, and to recommend at each regular meeting the acceptance or otherwise of all applications for investigation. This sub-committee shall meet at least once prior to each regular meeting of the Committee.

SEC. 2. There shall be appointed each February by the Chairman, from the membership, a sub-committee styled the "Sub-committee on Literature," consisting of six members. It shall be the duty of this sub-committee to examine carefully all papers that are published in the Institute's JOURNAL during

the current calendar year, and to report to the Committee not later than January of the following year, which, if any, of those papers deserve the award of the Louis Edward Levy Medal.

SEC. 3. There shall be appointed by the Chairman from the membership each February, a sub-committee styled the "Sub-committee on Awarding the Franklin Medal," the duty of which shall be to make recommendations of the award of this medal under the provisions of the deed of gift.

ARTICLE V.—*Sub-committees on Investigation of Applications*

SECTION 1. Upon the acceptance of an application for investigation, a sub-committee shall be appointed by the Chairman to conduct the investigation.

SEC. 2. Sub-committees shall be appointed from the membership of the Committee, but they may include a minority of other persons whose expert services are desired in the examination.

SEC. 3. When the personnel of a sub-committee on investigation is finally determined, a notice shall be sent to all members thereof giving the names of the members of the sub-committee.

SEC. 4. No person who is interested in the issue shall be a member of the sub-committee on investigation.

SEC. 5. An applicant for investigation may withdraw his application at any time before final action by the Committee; which withdrawal shall be reported to the Committee.

SEC. 6. When the Secretary has obtained the necessary information from the applicant, he shall notify the sub-committee, who shall then proceed with the investigation.

SEC. 7. Correspondence between the sub-committee and the applicant must be carried on through the office of the Secretary, in order that the official records shall be complete.

SEC. 8. Sub-committees shall whenever possible make direct examination and tests of the subject under investigation, and shall not accept tests, data or information furnished by others without first satisfying themselves as to the accuracy thereof. They shall in no case recommend an award solely on the basis of tests, data or information furnished by parties in any way interested in the subject of the award. When data submitted by persons not members of the sub-committee are included in the latter's report, it shall be so stated.

SEC. 9. Sub-committees must ascertain that articles, processes, products, etc., examined are genuine samples of the subject under investigation.

SEC. 10. Each sub-committee on investigation shall report its progress to the Committee at intervals of not more than two consecutive stated meetings; and any sub-committee failing so to report for four consecutive stated meetings may be discharged from further consideration of the subject at the discretion of the Chairman, who shall then appoint a new sub-committee to continue the investigation.

SEC. 11. Any member of a sub-committee on investigation failing to discharge his duties may be replaced by another member at the discretion of the Chairman.

SEC. 12. Sub-committees may request applicants to furnish drawings, diagrams or other exhibits for the purpose of investigations and for the records of the Committee.

SEC. 13. When it is found that the subject under investigation has become involved in litigation, the sub-committee shall defer further action until the litigation is terminated, or the Committee decides that the sub-committee may proceed.

ARTICLE VI.—*Sub-committee Meetings*

SECTION 1. A quorum for the transaction of business at any meeting of a sub-committee, properly called, shall consist of the one or more members present.

SEC. 2. No applicant or other person interested in the issue of an investigation shall be present at a meeting of a sub-committee or of the Committee except at the invitation of the sub-committee charged with the investigation.

ARTICLE VII.—*Sub-committees' Reports*

SECTION 1. Reports of progress and final reports of sub-committees shall be made to the Committee in writing. Final reports shall begin and end substantially as indicated in Form B hereto appended.

SEC. 2. When a sub-committee on investigation deems the subject upon which it reports worthy of an award of the Elliott Cresson Medal, the George R. Henderson Medal, the Walton Clark Medal, the Howard N. Potts Medal, the John Price Wetherill Medal, the Edward Longstreth Medal or the Certificate of Merit, it shall include in its report a recommendation to that effect; and such recommendations may be adopted by a majority vote of the Committee, but shall not be changed except by a vote of two-thirds of the members present.

SEC. 3. A report of a sub-committee on investigation, before its acceptance by the Committee, may be edited by the Secretary of the Institute in conjunction with the Chairman of the sub-committee, but without changing its meaning or effect.

SEC. 4. A report of a sub-committee on investigation, before its acceptance by the Committee, shall be signed by a majority of the members of the sub-committee charged with the investigation.

SEC. 5. Any member or members of a sub-committee may file a minority report at least three days prior to the meeting at which the majority report is to be presented.

SEC. 6. No member of a sub-committee shall be permitted to sign a report without having personally examined the subject under investigation, or taken part in its discussion at a meeting of the sub-committee.

SEC. 7. Reports of sub-committees on investigation shall be accompanied by such drawings, diagrams or other exhibits as will serve to elucidate the subject.

SEC. 8. All exhibits pertaining to reports shall be numbered, marked for identification, and signed by the Secretary of the Institute in substantially the following form, and the seal of the Institute shall be impressed thereon:—

Exhibit No. ———, pertaining to report of the Committee on Science and the Arts No. ———

Secretary.

SEC. 9. After the report of a sub-committee on investigation has passed its first reading before the Committee, a copy of its descriptive portion may be furnished the applicant, who may make an explanation or objections, in writing, addressed to the Chairman of the Committee; but such writing must be received not later than the next stated meeting of the Committee.

SEC. 10. The report of a sub-committee on investigation may be discussed and amended at the meeting of the Committee at which it is first presented, but shall be laid over for a second reading and final action until the next stated meeting; except where no recommendation of an award is made in the report, when it may, by a majority vote, be finally disposed of at the time of the first reading.

SEC. 11. Final action on a report of a sub-committee on investigation recommending an award shall not be taken unless at least one member of the sub-committee who signed the report is present.

ARTICLE VIII.—*Reconsideration*

SECTION 1. Upon the adoption of a report of a sub-committee, a motion for reconsideration must be made within the next three months. If such a motion is made and accepted, a vote of two-thirds of a quorum for final action shall be required to change the report as previously adopted.

SEC. 2. A second investigation of a subject shall not be ordered except on a vote of two-thirds of the members present at a stated meeting.

ARTICLE IX.—*Advertisement of Recommendations*

SECTION 1. Upon the adoption, by the Committee on Science and the Arts, of a report of a sub-committee on investigation setting forth that a discovery, invention, improvement or manufacture is worthy of an award of the Elliott Cresson Medal, the Howard N. Potts Medal, the George R. Henderson Medal or the John Price Wetherill Medal, publication shall be made in three successive issues of the JOURNAL OF THE FRANKLIN INSTITUTE, stating that at the expiration of three months from the date of the first publication, the person making such discovery, invention, improvement or manufacture shall be entitled to receive the award of the said medal, unless within the time satisfactory evidence shall have been submitted to the Committee on Science and the Arts of the want of originality or merit, in the supposed discovery, invention, improvement or manufacture.

SEC. 2. The adoption by the Committee on Science and the Arts of a report of a sub-committee recommending an award of the Franklin Medal, the Louis Edward Levy Medal, the Walton Clark Medal, the Edward Longstreth Medal or the Certificate of Merit, shall be conclusive without advertisement.

ARTICLE X.—*Protests*

SECTION 1. Protests against recommendations advertised by publication in the JOURNAL must be received within three months of the date of first publication. Such protests shall be presented to the Committee at its next

stated meeting following date of receipt, and shall be affirmed only by a vote of two-thirds of a quorum for final action, in which case a re-investigation shall be made.

ARTICLE XI.—*Institute Reports*

SECTION 1. Reports issued by the Institute shall begin and end substantially as in Form C appended. They shall be written upon an official form provided by the Institute.

SEC. 2. Reports when issued shall state that they are the action of The Franklin Institute by its Committee on Science and the Arts. They shall be attested by the President and the Secretary of the Institute and by the Chairman of the Committee, and shall be impressed with the seal of the Institute; and they may also bear the names of the members who signed the sub-committee's report.

SEC. 3. On the completion of an investigation, the applicant shall be provided with a certified copy of the Institute's report.

ARTICLE XII.—*Amendments to Regulations*

SECTION 1. Proposals to amend these regulations shall be presented to the Committee in writing, signed by at least two members. They may be considered when presented, but shall not be acted upon until the next stated meeting after presentation, and shall then be adopted if agreed to by two-thirds of the required quorum.

SEC. 2. Notice of proposed amendments shall be sent to each member on the programme for the meeting at which they may be acted upon.

Since much latitude is allowed by the terms of the several medal bequests and no rules for the making of Institute awards conflicting with the purpose and intent of the donors can be made, it is obviously not the part of wisdom to attempt too much in the way of definition. It is suggested that future awards be made with the following general understanding:

1. That the Certificate of Merit be awarded for meritorious inventions and physical processes.

2. That the Edward Longstreth Medal be awarded for invention of high order and for particularly meritorious improvements and developments in machines and mechanical processes.

3. That the John Price Wetherill Medal be awarded for discovery or invention in the physical sciences, or for new and important combinations of principles or methods already known.

4. That the Howard N. Potts Medal be awarded in recognition of important discoveries in physical science.

5. That the George R. Henderson Medal be awarded in recognition of meritorious inventions or discoveries in the field of railway engineering.

6. That the Elliott Cresson Medal be awarded in recognition of inventions of signal value and fundamentally important in the arts and industries.

7. That the Louis Edward Levy Medal be awarded in recognition of papers contributed to the JOURNAL of the Institute, which are of superior excellence and descriptive of a field in science or engineering to which the author has contributed fruitful research.

8. That the Franklin Medal continue to be awarded to those whose efforts have contributed most to a knowledge of physical science and its applications.

REPORT FORMS OF COMMITTEE ON SCIENCE AND THE ARTS

FORM A

(Application for Investigation)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

In the matter of your application to The Franklin Institute for a consideration of your invention or discovery entitled the following data are requested for the information of the Committee on Science and the Arts:

1. What is the specific purpose of the invention?
2. What is the condition of the prior art in this regard?
3. What improvement is claimed to be effected by the invention?
4. How is the improvement effected?
5. What patents, if any, have been issued for this invention?
6. What citations, if any, were made in this regard by the Patent Office before allowance of patent claims?
7. Is the invention now in actual use?
8. If so, since when?
9. Where may it be seen in operation?
10. Are you prepared to submit drawings of the apparatus or device?
11. Are you prepared to submit a model of the apparatus or device?
12. If the invention is a composition of matter, are you prepared to submit specimens of the ingredients and of the compound sufficient for the purpose of experiments?
13. If the invention is a chemical process, are you prepared to give a demonstration of the same?

IMPORTANT TO APPLICANT

This application carefully filled in and other available matters descriptive of the invention or process, together with two copies of each of the United States patents issued to applicant, must be returned promptly to the Secretary of The Franklin Institute, 15 South Seventh Street, Philadelphia, Pa.

(A copy of Form A, above, may be obtained from the Secretary of the Institute and must be filled in, signed and promptly returned by an applicant for an examination of and a report upon an invention or discovery.)

FORM B

(Sub-committee Report Form)

THE FRANKLIN INSTITUTE

OF THE

STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS

S. & A. Case No.

REPORT OF SUB-COMMITTEE, dated

Investigating

TO THE COMMITTEE ON SCIENCE AND THE ARTS:

Your sub-committee appointed to investigate the above subject reports
as follows:

.....

| | | |
|-------------------------|---|----------------------------|
| In consideration of the | { | discovery |
| | | excellence of construction |
| | | ingenuity and novelty |
| | | or |

ofyour sub-committee recommends

the award of to of

Respectfully submitted,

..... *Chairman.*

.....

.....

.....

Adopted at the Stated Meeting of 19

FORM C
(Institute Report Forms)
THE FRANKLIN INSTITUTE
OF THE
STATE OF PENNSYLVANIA
FOR THE
PROMOTION OF THE MECHANIC ARTS

HALL OF THE INSTITUTE,
Philadelphia,.....

S. & A. Case No.

The Franklin Institute of the State of Pennsylvania, acting through its
Committee on Science and the Arts, investigating

..... reports as follows:

.....

| | | |
|-------------------------|---|----------------------------|
| In consideration of the | { | discovery |
| | | excellence of construction |
| | | ingenuity and novelty |
| | | or |

of the Institute awards the.....

to of

..... *President.*

[SEAL]

..... *Secretary.*

Countersigned

Chairman of the Committee on Science and the Arts.

PRESIDENT'S REPORT AND REPORTS OF THE COMMITTEES OF THE INSTITUTE AND THE COMMITTEES OF ITS BOARD OF MANAGERS

REPORT OF THE PRESIDENT

FOR THE YEAR ENDED DECEMBER 31, 1926

To the Members of The Franklin Institute:

The end of the year brings to the President an opportunity to review, in his annual report, the activities of The Institute, and to record his appreciation of the work which has been so well carried on by the various Committees.

COMMITTEE ON MUSEUM

The Committee on Museum, Mr. Hugo Bilgram, Chairman, reports that the following additions have been made to the Institute's historical collections:

A clock with compensating pendulum devised by Mr. G. Morgan Eldridge and presented to the Institute by his stepdaughter, Miss L. S. Hawley, 3815 Chestnut Street, Philadelphia. Mr. Eldridge was a member of the Institute from 1874 to 1898, and served on the Board of Managers 1885-1890.

The Mond Nickel Company's 25th Anniversary Medal, given by The Mond Nickel Company, Limited, Victoria Station House, Victoria Street, London, S.W. 1, England.

Nine original drawings and two lithographs of locomotives formerly the property of Mr. Enoch Lewis, member of the Board of Managers 1868-1894, given by Mr. Theodore J. Lewis, Room 505 Morris Building, 1421 Chestnut Street, Philadelphia.

Portrait of Mr. Thomas Fletcher, Treasurer of the Institute 1824-1825, Member of the Board of Managers, 1826-1827, given by Mrs. Adeline Gardiner Clark, 502 Morton Avenue, Ridley Park, Penna.

Collotype print of Independence Hall, Philadelphia, given by the George Arthur Wonfor Company, 203 Mickle Street, Camden, N. J.

"The Declaration of Independence," painted by John Trumbull, engraved and printed by Illman Brothers, given by Illman Brothers, 296 East Brighthurst Street, Germantown, Philadelphia.

The Institute highly values these accessions, and records its thanks to the donors. It is timely to repeat and emphasize the statements in previous Annual Reports, that the present lack of space and facilities prevents the proper display and protection of the many notable exhibits in the Institute's historical collections. This condition will exist until a thoroughly equipped museum is provided. Active efforts are now being made to secure a suitable site on the Parkway, so that a museum worthy of the Institute's great traditions may be erected.

COMMITTEE ON PUBLICATIONS

The Committee on Publications, Mr. E. H. Sanborn, Chairman, reports that the issues of the Institute JOURNAL during 1926, complete Volumes 201 and 202. A change was made in the cover of the JOURNAL, and (beginning with Volume 201) it appeared in its new dress. The high standards of the JOURNAL have been maintained, the contents including not only the papers presented at the regular Institute meetings, but reports of the investigations being carried on by the Bartol Research Foundation Laboratories. During the year, 122 additional copies of Dr. W. J. Humphreys' lectures on "Physics of the Air," and 171 additional copies of Sir Joseph J. Thomson's collected articles on the "Electron in Chemistry," were sold.

COMMITTEE ON MEETINGS

The Committee on Meetings, Dr. Howard McClenahan, Chairman, reports that seven regular monthly meetings were held during the year, at which the business of the Institute was conducted and scientific papers read. The May meeting has, by action of the Board of Managers, been constituted "Medal Day," at which it is expected that presentation will be made of all the medals which have been awarded during the year upon recommendation of the Committee on Science and the Arts. The Franklin Medal and Certificate of Honorary Membership were awarded to Dr. Samuel Rea, Former President, Pennsylvania Railroad, and Professor Niels Bohr, Director of the Institute for Theoretical Physics, Copenhagen, Denmark. Awards were also made of the Longstreth, Wetherill, Levy and Cresson Medals. It is hoped that Medal Day will become an event of increasing importance in the activities of the Institute.

Eighteen weekly meetings were held, at which papers were read by distinguished visitors who reported upon some current matter of scientific interest. One of the regular weekly meetings was devoted to final reports upon the Delaware River Bridge by three of the engineers responsible for its construction. This meeting was a joint meeting with the Philadelphia Section of the American Society of Civil Engineers. One other meeting was devoted to the celebration of "Gas and Oil Power Week" and was a joint meeting of the Philadelphia Chapter-American Chemical Society; the Philadelphia Chapter-American Society of Mechanical Engineers, and the Engineers' Club, with The Franklin Institute. Three papers were read at this meeting on the general subject of "The By-products of Coal." At another of the weekly meetings, a reception to Dr. Walton Clark, for seventeen years President of the Institute, was held, to which all members of the Institute were invited. The Institute always delights to honor Doctor Clark for the splendid work he accomplished during the long period of his Presidency.

On May 21st special exercises were held in connection with the presentation of a portrait of Samuel Insull, Esq., founder of the Franklin Medal Fund. On this occasion a specially painted portrait of Mr. Insull was presented to the Institute by twenty-eight of Mr. Insull's friends and business associates, and speeches of presentation and acceptance of the portrait, of appreciation of the work and character of Mr. Insull and of the significance of the Franklin Medal, were made. The exercises of the afternoon, to which all members of the Institute were invited, were followed by a dinner in honor of Mr. Insull.

In making up the programme for the year the Committee on Meetings attempted to procure a paper of general scientific interest to be read at the monthly meetings, while the papers of more restricted or more technical character were presented at the regular weekly meetings. This arrangement seems to have worked well.

COMMITTEE ON LIBRARY

The Committee on Library, Mr. W. H. Fulweiler, Chairman, reports that there have been purchased, donated and obtained by increased binding, a total of 4586 accessions to the Library. These consist of 1012 bound volumes, 213 unbound volumes, 3349 pamphlets, 1 map, 9 drawings and 2 lithographs. The Institute is glad to record its thanks to Mr. Henry Howson, Mr. Wm. R. Webster, Philadelphia Book Company, Mr. Theodore J. Lewis, Shoemaker Bridge Company, Mr. Clarence A. Hall and the Philadelphia Office of the McGraw-Hill Publishing Company, Inc., for gifts of books, pamphlets and magazines. The Institute is again under obligation to the many scientific and technical societies throughout the world, the various government departments, state and municipal officials and the many industrial establishments who have from time to time supplied the library with publications on technical subjects. Statistics submitted by the Committee showing that the Library contains 85,152 bound and unbound volumes, 25,529 pamphlets, 2299 maps and charts, 1356 photographs and 795 drawings, designs, lithographs, etc., indicate the rich store of scientific and literary material which is available in the Library. The Committee again strongly urges that very serious consideration be given to providing increased space and equipment for the Library.

COMMITTEE ON SCIENCE AND THE ARTS

The Committee on Science and the Arts, Mr. Clarence A. Hall, Chairman, reports that investigation and final disposition were made of seventeen cases, and eleven new cases are now pending. Sixteen awards were made as a result of these investigations. The Sub-committee on New Subjects and Preliminary Examination held nine stated meetings during the year at which forty-six subjects were considered. Twelve of these were recommended for investigation and applications were received from eight of them. Four special cases were also recommended for investigation for which no application was required. These recommendations were accepted by the General Committee and Sub-committees of investigation were appointed. The standing Sub-committees on Literature and The Franklin Medal held their customary meetings, and recommended the award of this Medal and the other medals which were presented at the May meeting.

An outstanding event of the year was the presentation to the Institute by the United Gas Improvement Company, of a fund for the establishment of the Walton Clark Gold Medal. In presenting this fund the donors state:

"The income from this investment to be used to provide a medal to be awarded by the Institute, not more frequently than once a year, to the author of the most notable advance in knowledge or improvement in apparatus, or in method concerning the science or the art of gas manufacture or distribution or utilization in the production of illumination, or of heat, or of power."

The first award of this Medal was made to Doctor Walton Clark on the afternoon of Tuesday, December 21st. The award was made on the recommendation of the Committee on Science and the Arts in consideration of Doctor Clark's life work in the American gas industry and his distinguished and outstanding contributions to the technical progress in that industry.

Valuable service was rendered by a number of the members of the Committee in acting as members of the various juries of award at the Sesqui-Centennial International Exposition. Officials of the Exposition have expressed their appreciation of the service rendered. The character of this service may be judged by the fact that Mr. James S. Rogers was made Chairman and Mr. Harold Calvert, Secretary, of the Group Jury, before which cases came for final decision.

In the death, on February 22, 1926, of Mr. William H. Thorne, the Committee on Science and the Arts lost a member who had rendered a valued service for many years. His term of membership was unusually long, preparations having been made to recognize the fiftieth anniversary of his becoming a member, at the next meeting of the Committee after his death.

Two new members, Mr. N. W. Akimoff and Mr. William L. Brown, 3d, were elected to fill vacancies on the Committee.

COMMITTEE ON MEMBERSHIP

The Committee on Membership, Mr. R. W. Lesley, Chairman, reports that 140 new members were elected up to December 31, 1926. Resignations, members dropped for non-payment of dues, and the death of 37 members, bring the net increase in membership to 60. There are at present, in all classes of membership, 1470 members.

Nothing in the nature of a campaign for membership is being conducted, but a few members of the Board of Managers of the Institute have by personal effort obtained a considerable number of new members.

COMMITTEE ON FINANCE

The Committee on Finance, Mr. Walton Forstall, Chairman, reports the total expenses of the Institute during the fiscal year ended September 30, 1926, were \$65,205.67, and the total income \$53,877.54. Though this shows an operating deficit of \$11,328.13, there was, during the year, a net increase of assets over liabilities—amounting to \$7689.84; therefore, the figures show a definite gain.

The principal and accumulated income of the Bartol Research Foundation Fund now amount to \$1,666,585.96. The expenses of the Bartol Research Foundation were \$41,849.93 and the income \$90,022.49, showing a surplus of \$48,172.56.

BARTOL RESEARCH FOUNDATION

The work of the Bartol Research Foundation has been going ahead in a very satisfactory way under the able advisory direction of Dr. W. F. G. Swann, of the Sloane Laboratory, Yale University, and Professor E. P. Adams, of Princeton University. A number of important investigations of an unusual character have been made, the results of which are appearing in papers contrib-

uted from time to time to the JOURNAL of the Institute; also a series of afternoon lectures has been presented at the Institute and is being published in the JOURNAL. A number of additional Fellows have been appointed.

CHRISTMAS WEEK LECTURES FOR YOUNG PEOPLE

One of the innovations of the Institute's work during the past year was a series of four popular lectures with experiments for young people given during Christmas Week. These lectures were on the subject of "Recreations with Radiations" and were delivered by Professor R. W. Wood, head of the Department of Physics of Johns Hopkins University. A nominal charge of five dollars was made for this series of lectures. The Institute awarded prizes for the best note book records made by students who attended these lectures. For nearly a century, similar lectures have been given with preëminent success before the Royal Institution of London by such brilliant scientists as Faraday, Tyndall, Bragg, and others. Those lectures are so popular that there is a waiting list for the tickets; a gift of a ticket for the series is considered a most acceptable Christmas offering.

The success and continuance of these lectures from year to year are assured through a gift from Mrs. James Mapes Dodge to establish "The James Mapes Dodge Lecture Foundation" in memory of her husband, who was a very active member of the Institute, a member of the Board of Managers, and a Vice-President. This gift is Five Thousand Dollars in cash and in addition an annual payment to the Institute, during her lifetime, of Two Hundred and Fifty Dollars. I am glad to record the Institute's great appreciation to Mrs. Dodge for this generous gift.

AUDIT

Lybrand, Ross Bros. and Montgomery, certified public accountants, audited the accounts for the fiscal year ended September 30, 1926, and reported them to be correct.

All of the work of the Institute has been carried on most capably during the past year under the direction of Dr. Howard McClenahan, the Secretary; and the staffs of both the Institute and the Bartol Research Foundation have, by their continued faithful service and interest, maintained the high standards of the Institute. It is a pleasure to express to them and to all of the Committees my great appreciation of their efforts.

Respectfully submitted,

WM. C. L. EGLIN,
President.

Note—May 20, 1927.—We are glad to announce that Doctor Swann has accepted the invitation to become the first Director of the Bartol Research Foundation Laboratories. He will assume this office on September 1, 1927. It is a matter of first importance to the Institute that the Bartol Research Foundation Laboratories are to be under Dr. W. F. G. Swann as Director. He is the head of the Department of Physics, Yale University, and is one of the leading physicists and research men of the United States. In him the Bartol Laboratories will have a distinguished and enthusiastic leader.

REPORT OF THE COMMITTEE ON LIBRARY

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1926

To the President and Members of the Franklin Institute:

The Committee on Library respectfully submits the following statement of activities in the Library during the year ending September 30, 1926.

The additions to the Library were as follows:

| Source. | Bound Volumes. | Unbound Volumes. | Pamphlets. | Maps. | Draw- ings. | Litho- graphs. |
|-----------------------|-------------------|---------------------|-------------|----------|----------------|-------------------|
| By Gift | 230 | 178 | 3346 | 1 | 9 | 2 |
| Binding | 616 | | | | | |
| Purchase | | | | | | |
| Books and Periodicals | 5 | 4 | | | | |
| Jayne Fund | 4 | 1 | | | | |
| Journal | 33 | 6 | 1 | | | |
| Lea Fund | 16 | 9 | 1 | | | |
| Levy Fund | 13 | 1 | | | | |
| Memorial Lib'y Fund | 3 | | | | | |
| Moore Fund | 36 | 3 | | | | |
| Morris Fund | 21 | 1 | | | | |
| Potts Fund | 10 | | | | | |
| Ware Fund | 25 | 10 | 1 | | | |
| | <u>1012</u> | <u>213</u> | <u>3349</u> | <u>1</u> | <u>9</u> | <u>2</u> |
| Total additions | | | | | | 4586 |

The Committee had at its disposal \$3994.70 appropriated by the Board of Managers and \$2962.29 income of the various trust funds.

The expenditures for the year were \$1405.12 for binding; \$4660.22 for books and subscriptions to magazines and other periodical publications, and \$612.38 for general expenses.

Gifts of books, pamphlets and magazines were received from Mr. Henry Howson, Mr. Wm. R. Webster, Philadelphia Book Company, Mr. Theodore J. Lewis, Shoemaker Bridge Company, Mr. Clarence A. Hall, and the Philadelphia Office of the McGraw-Hill Publishing Company, Inc.

The Institute is again under obligations to the many scientific and technical societies throughout the world, the various government departments, state and municipal officials and to the many industrial establishments who have from time to time supplied the library with publications on technical subjects.

The contents of the Library on September 30, 1926, were:

| | |
|---|--------|
| Volumes, bound and unbound | 85,152 |
| Pamphlets | 25,529 |
| Maps and charts | 2,299 |
| Photographs | 1,356 |
| Drawings, Designs, Lithographs, etc. | 795 |

Binding:

During the year the following work was done by the binders:

| | |
|--|-----|
| Recent volumes of periodicals | 577 |
| Volumes of magazines charged to Chemical Periodicals | |
| Binding Fund | 39 |
| Volumes charged to the Ware Fund | 66 |
| Old volumes bound | 71 |
| Old volumes rebound | 34 |

Magazines and other periodical publications:

6387 copies of the JOURNAL were distributed for exchange purposes.

26 new exchanges were added to the mailing list and 23 were removed.

The total number of exchanges on September 30 was 525.

The subscriptions for the year totalled 214. These were distributed geographically as follows:

| | |
|-----------------------|-----|
| Domestic | 112 |
| German | 60 |
| English | 19 |
| French | 12 |
| Belgian | 3 |
| Czechoslovakian | 2 |
| Italian | 2 |
| Swiss | 1 |
| South African | 1 |
| Australian | 1 |
| Indian | 1 |

The number of publications received by gift was 270, making the total periodical publications received by the Library during the year 1009.

It will be noted that there has been a considerable increase in the total additions to the Library last year but these have been mainly in the form of pamphlets.

While there have been added several steel stacks on the third floor, the Library is still in urgent need of additional stack space for the proper care and handling of our books. The Library Committee wishes again to call attention to the serious conditions under which they are laboring in connection with a very large number of unbound publications. Such material is almost unavailable, is very difficult to handle and requires considerably greater space for storage than the bound books. Furthermore, in connection with the patents, we are obligated by the terms under which we receive these patent specifications to keep them available for public use; in many cases, this is only theoretically possible.

We would strongly urge that the Finance Committee give serious consideration to this very serious problem to the end that we may make all of the material in the Library available and thus greatly increase its usefulness.*

No changes have occurred in the Library staff during the past year.

Respectfully submitted,

W. H. FULWEILER,

Chairman.

PHILADELPHIA, January 12, 1927.

*Since the above report was presented, the Board of Managers has made a grant of \$5000 for binding the U. S. Patent Specifications. This grant will bring the binding of this literature strictly up to date, and will make it fully available for convenient use.

The Librarian.

REPORT OF THE COMMITTEE ON MUSEUM**FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1926***To the President and Members of The Franklin Institute:*

The following additions have been made to the Institute's historic collections:

Clock with compensating pendulum devised by Mr. G. Morgan Eldridge and presented to the Institute by his stepdaughter, Miss L. S. Hawley, 3815 Chestnut Street, Philadelphia. Mr. Eldridge was a member of the Institute from 1874 to 1898, and served on the Board of Managers 1885-1890.

The Mond Nickel Company's 25th Anniversary Medal, given by The Mond Nickel Company, Limited, Victoria Station House, Victoria Street, London, S. W. 1, England, March 4, 1926.

Nine original drawings and two lithographs of locomotives formerly the property of Mr. Enoch Lewis, member of the Board of Managers 1868-1894, given by Mr. Theodore J. Lewis, Room 505 Morris Building, 1421 Chestnut Street, Philadelphia, March 4, 1926.

Portrait of Mr. Thomas Fletcher, Treasurer of the Institute, 1824-1825, member of the Board of Managers, 1826-1827, given by Mrs. Adeline Gardiner Clark, 502 Morton Avenue, Ridley Park, Penna., June 23, 1926.

Collotype print of Independence Hall, Philadelphia, given by the George Arthur Wonfor Company, 203 Mickle Street, Camden, N. J., June 28, 1926.

"The Declaration of Independence" painted by John Trumbull, engraved and printed by Illman Brothers, given by Illman Brothers, 296 East Brighthurst Street, Germantown, Philadelphia, July 29, 1926.

Respectfully submitted,

HUGO BILGRAM,
Chairman.

PHILADELPHIA, January 12, 1927.

REPORT OF THE COMMITTEE ON MEETINGS**FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1926***To the President and Members of The Franklin Institute:*

In the formulation of the programme of the meetings for the year, the Committee attempted to have a paper of general interest and of at least semi-popular character read at each monthly meeting of the Institute. At the other meetings, which were formerly called Section Meetings, the more technical and restricted papers were presented. A brief consideration of the meetings of the year will make this point clear.

In October Professor E. G. Conklin of Princeton spoke upon, "Why Teach Evolution?" in November Professor Brown of Yale spoke on "The Recent Solar Eclipse and Its Results," in December, Professor R. W. Wood of Johns Hopkins spoke on "Optical Excitation of Metallic Spectra," in January Dr. Charles H. Mayo spoke on "Light and Health," in February Professor Lyman of Harvard spoke on "Radiations," in March Colonel E. Lester Jones, Director of the U. S. Coast and Geodetic Survey spoke on "Science and the Earthquake Peril," in April Dr. C. F. Marvin, Chief of the Weather Bureau,

REPORT OF THE COMMITTEE ON MUSEUM**FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1926***To the President and Members of The Franklin Institute:*

The following additions have been made to the Institute's historic collections:

Clock with compensating pendulum devised by Mr. G. Morgan Eldridge and presented to the Institute by his stepdaughter, Miss L. S. Hawley, 3815 Chestnut Street, Philadelphia. Mr. Eldridge was a member of the Institute from 1874 to 1898, and served on the Board of Managers 1885-1890.

The Mond Nickel Company's 25th Anniversary Medal, given by The Mond Nickel Company, Limited, Victoria Station House, Victoria Street, London, S. W. 1, England, March 4, 1926.

Nine original drawings and two lithographs of locomotives formerly the property of Mr. Enoch Lewis, member of the Board of Managers 1868-1894, given by Mr. Theodore J. Lewis, Room 505 Morris Building, 1421 Chestnut Street, Philadelphia, March 4, 1926.

Portrait of Mr. Thomas Fletcher, Treasurer of the Institute, 1824-1825, member of the Board of Managers, 1826-1827, given by Mrs. Adeline Gardiner Clark, 502 Morton Avenue, Ridley Park, Penna., June 23, 1926.

Collotype print of Independence Hall, Philadelphia, given by the George Arthur Wonfor Company, 203 Mickle Street, Camden, N. J., June 28, 1926.

"The Declaration of Independence" painted by John Trumbull, engraved and printed by Illman Brothers, given by Illman Brothers, 296 East Brighthurst Street, Germantown, Philadelphia, July 29, 1926.

Respectfully submitted,

HUGO BILGRAM,
Chairman.

PHILADELPHIA, January 12, 1927.

REPORT OF THE COMMITTEE ON MEETINGS**FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1926***To the President and Members of The Franklin Institute:*

In the formulation of the programme of the meetings for the year, the Committee attempted to have a paper of general interest and of at least semi-popular character read at each monthly meeting of the Institute. At the other meetings, which were formerly called Section Meetings, the more technical and restricted papers were presented. A brief consideration of the meetings of the year will make this point clear.

In October Professor E. G. Conklin of Princeton spoke upon, "Why Teach Evolution?" in November Professor Brown of Yale spoke on "The Recent Solar Eclipse and Its Results," in December, Professor R. W. Wood of Johns Hopkins spoke on "Optical Excitation of Metallic Spectra," in January Dr. Charles H. Mayo spoke on "Light and Health," in February Professor Lyman of Harvard spoke on "Radiations," in March Colonel E. Lester Jones, Director of the U. S. Coast and Geodetic Survey spoke on "Science and the Earthquake Peril," in April Dr. C. F. Marvin, Chief of the Weather Bureau,

| | |
|--|-----|
| Recent volumes of periodicals | 577 |
| Volumes of magazines charged to Chemical Periodicals | |
| Binding Fund | 39 |
| Volumes charged to the Ware Fund | 66 |
| Old volumes bound | 71 |
| Old volumes rebound | 34 |

Magazines and other periodical publications:

6387 copies of the JOURNAL were distributed for exchange purposes.

26 new exchanges were added to the mailing list and 23 were removed.

The total number of exchanges on September 30 was 525.

The subscriptions for the year totalled 214. These were distributed geographically as follows:

| | |
|-----------------------|-----|
| Domestic | 112 |
| German | 60 |
| English | 19 |
| French | 12 |
| Belgian | 3 |
| Czechoslovakian | 2 |
| Italian | 2 |
| Swiss | 1 |
| South African | 1 |
| Australian | 1 |
| Indian | 1 |

The number of publications received by gift was 270, making the total periodical publications received by the Library during the year 1009.

It will be noted that there has been a considerable increase in the total additions to the Library last year but these have been mainly in the form of pamphlets.

While there have been added several steel stacks on the third floor, the Library is still in urgent need of additional stack space for the proper care and handling of our books. The Library Committee wishes again to call attention to the serious conditions under which they are laboring in connection with a very large number of unbound publications. Such material is almost unavailable, is very difficult to handle and requires considerably greater space for storage than the bound books. Furthermore, in connection with the patents, we are obligated by the terms under which we receive these patent specifications to keep them available for public use; in many cases, this is only theoretically possible.

We would strongly urge that the Finance Committee give serious consideration to this very serious problem to the end that we may make all of the material in the Library available and thus greatly increase its usefulness.*

No changes have occurred in the Library staff during the past year.

Respectfully submitted,

W. H. FULWEILER,
Chairman.

PHILADELPHIA, January 12, 1927.

*Since the above report was presented, the Board of Managers has made a grant of \$5000 for binding the U. S. Patent Specifications. This grant will bring the binding of this literature strictly up to date, and will make it fully available for convenient use.

The Librarian.

REPORT OF THE COMMITTEE ON MUSEUM**FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1926***To the President and Members of The Franklin Institute:*

The following additions have been made to the Institute's historic collections:

Clock with compensating pendulum devised by Mr. G. Morgan Eldridge and presented to the Institute by his stepdaughter, Miss L. S. Hawley, 3815 Chestnut Street, Philadelphia. Mr. Eldridge was a member of the Institute from 1874 to 1898, and served on the Board of Managers 1885-1890.

The Mond Nickel Company's 25th Anniversary Medal, given by The Mond Nickel Company, Limited, Victoria Station House, Victoria Street, London, S. W. 1, England, March 4, 1926.

Nine original drawings and two lithographs of locomotives formerly the property of Mr. Enoch Lewis, member of the Board of Managers 1868-1894, given by Mr. Theodore J. Lewis, Room 505 Morris Building, 1421 Chestnut Street, Philadelphia, March 4, 1926.

Portrait of Mr. Thomas Fletcher, Treasurer of the Institute, 1824-1825, member of the Board of Managers, 1826-1827, given by Mrs. Adeline Gardiner Clark, 502 Morton Avenue, Ridley Park, Penna., June 23, 1926.

Collotype print of Independence Hall, Philadelphia, given by the George Arthur Wonfor Company, 203 Mickle Street, Camden, N. J., June 28, 1926.

"The Declaration of Independence" painted by John Trumbull, engraved and printed by Illman Brothers, given by Illman Brothers, 296 East Brighthurst Street, Germantown, Philadelphia, July 29, 1926.

Respectfully submitted,

HUGO BILGRAM,
Chairman.

PHILADELPHIA, January 12, 1927.

REPORT OF THE COMMITTEE ON MEETINGS**FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1926***To the President and Members of The Franklin Institute:*

In the formulation of the programme of the meetings for the year, the Committee attempted to have a paper of general interest and of at least semi-popular character read at each monthly meeting of the Institute. At the other meetings, which were formerly called Section Meetings, the more technical and restricted papers were presented. A brief consideration of the meetings of the year will make this point clear.

In October Professor E. G. Conklin of Princeton spoke upon, "Why Teach Evolution?" in November Professor Brown of Yale spoke on "The Recent Solar Eclipse and Its Results," in December, Professor R. W. Wood of Johns Hopkins spoke on "Optical Excitation of Metallic Spectra," in January Dr. Charles H. Mayo spoke on "Light and Health," in February Professor Lyman of Harvard spoke on "Radiations," in March Colonel E. Lester Jones, Director of the U. S. Coast and Geodetic Survey spoke on "Science and the Earthquake Peril," in April Dr. C. F. Marvin, Chief of the Weather Bureau,

REPORT OF THE COMMITTEE ON MUSEUM**FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1926***To the President and Members of The Franklin Institute:*

The following additions have been made to the Institute's historic collections:

Clock with compensating pendulum devised by Mr. G. Morgan Eldridge and presented to the Institute by his stepdaughter, Miss L. S. Hawley, 3815 Chestnut Street, Philadelphia. Mr. Eldridge was a member of the Institute from 1874 to 1898, and served on the Board of Managers 1885-1890.

The Mond Nickel Company's 25th Anniversary Medal, given by The Mond Nickel Company, Limited, Victoria Station House, Victoria Street, London, S. W. 1, England, March 4, 1926.

Nine original drawings and two lithographs of locomotives formerly the property of Mr. Enoch Lewis, member of the Board of Managers 1868-1894, given by Mr. Theodore J. Lewis, Room 505 Morris Building, 1421 Chestnut Street, Philadelphia, March 4, 1926.

Portrait of Mr. Thomas Fletcher, Treasurer of the Institute, 1824-1825, member of the Board of Managers, 1826-1827, given by Mrs. Adeline Gardiner Clark, 502 Morton Avenue, Ridley Park, Penna., June 23, 1926.

Collotype print of Independence Hall, Philadelphia, given by the George Arthur Wonfor Company, 203 Mickle Street, Camden, N. J., June 28, 1926.

"The Declaration of Independence" painted by John Trumbull, engraved and printed by Illman Brothers, given by Illman Brothers, 296 East Bringham Street, Germantown, Philadelphia, July 29, 1926.

Respectfully submitted,

HUGO BILGRAM,
Chairman.

PHILADELPHIA, January 12, 1927.

REPORT OF THE COMMITTEE ON MEETINGS**FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1926***To the President and Members of The Franklin Institute:*

In the formulation of the programme of the meetings for the year, the Committee attempted to have a paper of general interest and of at least semi-popular character read at each monthly meeting of the Institute. At the other meetings, which were formerly called Section Meetings, the more technical and restricted papers were presented. A brief consideration of the meetings of the year will make this point clear.

In October Professor E. G. Conklin of Princeton spoke upon, "Why Teach Evolution?" in November Professor Brown of Yale spoke on "The Recent Solar Eclipse and Its Results," in December, Professor R. W. Wood of Johns Hopkins spoke on "Optical Excitation of Metallic Spectra," in January Dr. Charles H. Mayo spoke on "Light and Health," in February Professor Lyman of Harvard spoke on "Radiations," in March Colonel E. Lester Jones, Director of the U. S. Coast and Geodetic Survey spoke on "Science and the Earthquake Peril," in April Dr. C. F. Marvin, Chief of the Weather Bureau,

| | |
|--|-----|
| Recent volumes of periodicals | 577 |
| Volumes of magazines charged to Chemical Periodicals | |
| Binding Fund | 39 |
| Volumes charged to the Ware Fund | 66 |
| Old volumes bound | 71 |
| Old volumes rebound | 34 |

Magazines and other periodical publications:

6387 copies of the JOURNAL were distributed for exchange purposes.

26 new exchanges were added to the mailing list and 23 were removed.

The total number of exchanges on September 30 was 525.

The subscriptions for the year totalled 214. These were distributed geographically as follows:

| | |
|-----------------------|-----|
| Domestic | 112 |
| German | 60 |
| English | 19 |
| French | 12 |
| Belgian | 3 |
| Czechoslovakian | 2 |
| Italian | 2 |
| Swiss | 1 |
| South African | 1 |
| Australian | 1 |
| Indian | 1 |

The number of publications received by gift was 270, making the total periodical publications received by the Library during the year 1009.

It will be noted that there has been a considerable increase in the total additions to the Library last year but these have been mainly in the form of pamphlets.

While there have been added several steel stacks on the third floor, the Library is still in urgent need of additional stack space for the proper care and handling of our books. The Library Committee wishes again to call attention to the serious conditions under which they are laboring in connection with a very large number of unbound publications. Such material is almost unavailable, is very difficult to handle and requires considerably greater space for storage than the bound books. Furthermore, in connection with the patents, we are obligated by the terms under which we receive these patent specifications to keep them available for public use; in many cases, this is only theoretically possible.

We would strongly urge that the Finance Committee give serious consideration to this very serious problem to the end that we may make all of the material in the Library available and thus greatly increase its usefulness.*

No changes have occurred in the Library staff during the past year.

Respectfully submitted,

W. H. FULWEILER,
Chairman.

PHILADELPHIA, January 12, 1927.

*Since the above report was presented, the Board of Managers has made a grant of \$5000 for binding the U. S. Patent Specifications. This grant will bring the binding of this literature strictly up to date, and will make it fully available for convenient use.

The Librarian.

REPORT OF THE COMMITTEE ON MUSEUM**FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1926***To the President and Members of The Franklin Institute:*

The following additions have been made to the Institute's historic collections:

Clock with compensating pendulum devised by Mr. G. Morgan Eldridge and presented to the Institute by his stepdaughter, Miss L. S. Hawley, 3815 Chestnut Street, Philadelphia. Mr. Eldridge was a member of the Institute from 1874 to 1898, and served on the Board of Managers 1885-1890.

The Mond Nickel Company's 25th Anniversary Medal, given by The Mond Nickel Company, Limited, Victoria Station House, Victoria Street, London, S. W. 1, England, March 4, 1926.

Nine original drawings and two lithographs of locomotives formerly the property of Mr. Enoch Lewis, member of the Board of Managers 1868-1894, given by Mr. Theodore J. Lewis, Room 505 Morris Building, 1421 Chestnut Street, Philadelphia, March 4, 1926.

Portrait of Mr. Thomas Fletcher, Treasurer of the Institute, 1824-1825, member of the Board of Managers, 1826-1827, given by Mrs. Adeline Gardiner Clark, 502 Morton Avenue, Ridley Park, Penna., June 23, 1926.

Collotype print of Independence Hall, Philadelphia, given by the George Arthur Wonfor Company, 203 Mickle Street, Camden, N. J., June 28, 1926.

"The Declaration of Independence" painted by John Trumbull, engraved and printed by Illman Brothers, given by Illman Brothers, 296 East Brighthurst Street, Germantown, Philadelphia, July 29, 1926.

Respectfully submitted,

HUGO BILGRAM,
Chairman.

PHILADELPHIA, January 12, 1927.

REPORT OF THE COMMITTEE ON MEETINGS**FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1926***To the President and Members of The Franklin Institute:*

In the formulation of the programme of the meetings for the year, the Committee attempted to have a paper of general interest and of at least semi-popular character read at each monthly meeting of the Institute. At the other meetings, which were formerly called Section Meetings, the more technical and restricted papers were presented. A brief consideration of the meetings of the year will make this point clear.

In October Professor E. G. Conklin of Princeton spoke upon, "Why Teach Evolution?" in November Professor Brown of Yale spoke on "The Recent Solar Eclipse and Its Results," in December, Professor R. W. Wood of Johns Hopkins spoke on "Optical Excitation of Metallic Spectra," in January Dr. Charles H. Mayo spoke on "Light and Health," in February Professor Lyman of Harvard spoke on "Radiations," in March Colonel E. Lester Jones, Director of the U. S. Coast and Geodetic Survey spoke on "Science and the Earthquake Peril," in April Dr. C. F. Marvin, Chief of the Weather Bureau,

and Its Results." He stated that in the study of the eclipse, three purposes are to be accomplished: A determination of the exact position of the moon when it is "new"; a study of the corona; and the exact timing of the sun and the moon. The recent eclipse was undoubtedly witnessed by more persons of trained intellect than any other eclipse that has ever taken place. Several positive results were obtained during the eclipse. The belief that there is no infra-mercurial planet was confirmed. A complete understanding of the phenomena of shadow bands was arrived at. They were shown to be due to refraction effects of the light coming from the edge of the sun when it has become so narrow that it may be considered as a slit source of light. New views of the corona were taken. The lecturer showed many beautiful pictures taken during the eclipse.

Thursday, December 3, 1925: Dr. E. F. Northrup, Inventor and Scientific Head of the Ajax Electrothermic Corporation, spoke on "Electric Induction Furnace Working." The lecturer prefaced his talk by a reference to the fact that he had read his first scientific paper in the Hall of the Institute thirty-three years before. He took up the subject of the evening and showed the fundamental requirements involved in the solution of the problem of electric heating. He outlined the various features which had to be considered in determining the type and the size of furnace to be adopted for any purpose. He presented convincing arguments to prove that the induction furnace offered the most satisfactory solution of this important industrial problem.

Thursday, December 10, 1925: Dr. Walter van B. Roberts, Consulting Engineer, The Radio Corporation of America, lectured before the Institute on "Recent Developments in Radio Theory." He first of all showed how "wave traps" could be used to shut out the disturbances from superpower stations in order to permit reception from weaker stations. The use of such traps was made necessary by the opening of a fifty kilowatt station in New Jersey. He then took up the discussion of methods for generating and measuring very weak radio frequency currents. He described several methods devised by him for this purpose and made a comparison of the results obtainable by the methods named. In the discussion of the paper, he outlined some of the many applications of the Wheatstone's Bridge scheme of connections to radio procedure.

Wednesday, December 16, 1925: Professor R. W. Wood, Professor of Experimental Physics, Johns Hopkins University, presented a brilliant paper entitled "Optical Excitation of Metallic Spectra." At the outset Professor Wood spoke of crystalline quartz and fused quartz and their characteristics. He displayed photographs evidencing the presence of minute particles in quartz which produced a scattering of light passing through the quartz. He then showed by photographs that with change of temperature there was a change of absorption toward the visible spectrum. He defined optical excitation as the production by illumination of luminosity from metallic vapors. He demonstrated such luminosities as resonance radiations after stating that such radiations could not be explained by the old theory of light, but could be explained easily by the quantum theory. He explained in this way the fact that if sodium vapor were excited by light of only one D line, the vapor would emit light of only that one wave length. He spoke of the effect of the magnetic field

upon the polarization of resonance radiations and pointed out how polarization of light could be destroyed by a magnetic field of the strength of the earth's field. He demonstrated the experimental arrangement which showed that the presence of nitrogen at low pressures in the vacuum may increase the luminosity greatly. He showed experimentally samples of resonance radiation and demonstrated the production of such radiation by ultra-violet light. He closed his lecture by an experimental display of a time lag of the luminosity of hydrogen excited by ultra-violet light behind the ultra-violet light producing the luminosity.

Thursday, January 7, 1926: John Lyle Harrington, C.E., Consulting Engineer, Kansas City, Missouri, past president of the American Society of Mechanical Engineers and advisory bridge engineer, spoke on "Movable Bridges." The lecturer stated that the construction of bridges dates back to the time of Julius Cæsar. There was little change of bridge construction until the need for the bridging of navigable streams caused the beginning of the development of present day bridges. The rights of navigation were dominant and demanded that bridges should be movable. Swing bridges were developed early because of the railroads. The first vertical lift bridge was built in Chicago thirty-five years ago. The bascule type of bridge developed simultaneously with the vertical lift bridge, and proved to be more economical because of height and clearance. The lecture was generously illustrated with photographs and drawings of the various types of bridges, and showed samples of bridges which had been in actual use for many years. The reading of the paper was followed by an animated discussion which continued for well nigh an hour.

Thursday, January 14, 1926: Stuart C. Dodd, Fellow in Applied Psychology, Princeton University, lectured on "Applications and Mechanical Calculation of Correlation Coefficients." The talk was divided into two portions: "Applications" and "Calculations." The lecturer first defined the term "correlation" and pointed out its significance. He cited many varieties of correlation, such as rectilinear and curvilinear, partial, multiple and reliability correlations, with the conditions of ranging and sampling. He illustrated by examples from insurance and employment offices, agricultural, educational, and other biometric fields of research. Under the heading of "Calculation" he enlarged upon the arithmetic of correlation and showed the significance of the means, standard deviations and correlation formulæ. He then demonstrated a mechanical calculator designed by him and used especially in the calculation of intelligence coefficients for candidates for college admission. With this machine Mr. Dodd can make five statistical calculations with one turn of the handle. At the end of the meeting the audience kept the lecturer occupied for a considerable time explaining and demonstrating his machine.

Wednesday, January 20, 1926: Dr. C. E. K. Mees, Director of the Research Laboratories of the Eastman Kodak Company, gave a brilliant talk on "The Color Sensitivity of Photographic Materials." He described at length the efforts which had been made by the Eastman Company to produce photographic plates in particular which are sensitive to the longer light waves. Step by step the development of infra-red sensitive plates was described and the results obtained thereby were shown photographically, as well as by description. Wave lengths of more than nine thousand light units could be photographically

recorded by the plates so developed. The lecturer then showed experimentally the importance of the use of such red sensitive plates. The changed appearance of any scene when photographed by red or infra-red light, the photographs taken from great heights by red light which permitted the getting rid of much of the mistiness of the atmosphere, and especially photographs taken from a mountain top with both ordinary light and light of long wave length, were shown. With the usual photographic plate a landscape ten or twelve miles away could be pictured; while with the very long light waves, views a hundred and forty miles away could be recorded. The lecturer finally showed the difference in appearance of the planet Mars when photographed by blue sensitive plates and by red sensitive plates, and suggested that clearer ideas of the real surface of Mars might be attained in this way. The paper was followed by a protracted and vigorous discussion.

Thursday, January 28, 1926: Dr. Charles H. Mayo of the Mayo Clinic, Rochester, Minnesota, spoke before a crowded lecture room on "Light and Health." Doctor Mayo outlined the development of the theories of disease and their cures and indicated much of the former practice of medicine. He showed a development of many of the modern practices and illustrated in various ways the evolution of the different organs of animals. He outlined also the discoveries which had led to the use of light as a curative agency, and explained the effect of ultra-violet light upon the skin and the various secretions of the body. He expressed the belief that future developments in medicine would result from an increased knowledge and application of chemistry.

Thursday, February 4, 1926: Dr. Louis C. Loewenstein, Consulting Electrical Engineer, spoke before the Institute on "Latest and Future Developments in Power Generation." The lecturer spoke of the amount of power used in any country as an index to the prosperity of that country, and summarized the industrial conditions of various countries from this point of view. He pointed out several economies which had been effected in power development in recent years, and indicated the probable future economies. He made a quantitative comparison of the effects of the several possible means of improvement, showed the influence of high temperature and high pressure, and outlined the progressive increases of these two quantities in recent engineering practice. The lecturer showed strikingly the value of research investigations by which the phenomenon of supersaturation of steam was discovered. The re-design of steam nozzle in turbines brought about by this research resulted in an increase of the efficiency of the steam plant by eight units. Doctor Loewenstein showed many illustrations of modern power plants and pointed out their characteristic features. He closed his talk with a comprehensive summary of the possibilities of using mercury as the fluid in turbines, and the advantages of such use.

Thursday, February 11, 1926: Mr. E. W. Smith, Factory Engineer, The Electric Storage Battery Company of Philadelphia, spoke on "Storage Batteries." The lecturer first told what a storage battery is, what it does, and how it is made, and made a critical survey of the various combinations of materials which might be used in the production of storage cells. He expressed the belief, based upon experience, that the lead battery, on the whole, gave most satisfactory service. He carried on a running comparison between the lead cell and the Edison Storage cell, and pointed out the various particulars in which

the one or the other showed the advantage. The theory of the chemical actions involved was discussed and the influence of change of the nature of material, the physical character of the plate, and the use of insulating separators, were clearly shown. Finally, the particularly strong points of the two types of cells were displayed.

Wednesday, February 17, 1926: Major Theodore Lyman, Professor of Physics and Director of the Jefferson Physical Laboratory of Harvard University spoke on "Radiations." He discussed at the outset, in a cursory way, radiations in general from the longest known ones to the extremely short X-rays. A diagram of all such radiations was drawn on a logarithmic scale. He pointed out the exceedingly small portion of this diagram which was covered by visible light rays. Major Lyman spoke especially of the region of Schumann's rays and especially of that region out to 200 Angstrom units, which rays are known as "Lyman rays." Beyond the Lyman rays is a sort of "no man's land" which has not yet been traversed. Beyond that region come the X-rays which are being successfully attacked by diffraction and the study of crystal lattices. Major Lyman described the work of Schumann and then the improvements in apparatus and in technic which had been introduced by himself. By these improvements he had measured wave lengths out to 250 a.u. He illustrated application of the Balmer series and the demands of modern theories of modern atomic structure. He pointed out the change in the helium spectrum which was produced by ionization, and stated that with increasing ionization the spectral series moves towards the extreme ultra-violet. The lecturer discussed Millikan's brilliant work in the Schumann region and used it to test the validity of the Mosley rule connecting the atomic principle and the X-ray radiation of different substances. He finally pointed out the fundamental character of research work in the field of the extreme ultra-violet.

Thursday, February 25, 1926: Professor Malcolm MacLaren, Chairman of the Department of Electrical Engineering, Princeton University, read a paper on "The Interpole Motor in Theory and Practice." He gave an interesting historical sketch of the development of the direct current motor from the days of Faraday on, and pointed out the reasons for the particular type of motor under consideration. He showed the necessities for regulation of the motor and stabilization of the magnetic field which led to the particular type. This was followed by a review of the characteristics of the interpole motor and of the favorable results which are gotten by means of it.

Thursday, March 4, 1926: A joint meeting of the Philadelphia Section of the American Society of Civil Engineers and The Franklin Institute was substituted for the regular weekly meeting of the Institute alone. The meeting was the final one of a series devoted to the engineering features of the Delaware River Bridge. Three papers were read by engineers responsible in the design and construction of the bridge for the particular phase of the work discussed. "The Erection of the Suspended Structure" by R. G. Cone, "The Cable Calculations" by G. M. Rapp, and "The Construction of the Cables" by H. D. Robinson. The three papers were authoritative, complete and admirably written. They were splendidly illustrated by diagrams made in connection with the bridge and photographs taken of the work. Mr. Robinson who spoke first, described exhaustively, the procedure followed in the laying of the cables.

He stated that in each cable there were 18,666 number 6 wires. Mr. Rapp in describing the design of the cables pointed out the essential things to be obtained: the necessary strength of the cables, the correct length of the cables, and the neutralizing of the elastic forces brought into play in the towers by the shifting loads and the varying temperatures. He showed how these forces were taken care of by the bending of the towers. Mr. Cone showed, chiefly by photographs, the erection of the suspended structure and pointed out the many improvements in such work which had been utilized for the first time in this bridge. This final meeting devoted to the construction of the bridge was regarded as a thorough success.

Thursday, March 11, 1926: Professor W. Chittin Wetherill, Department of Mechanical Engineering of the University of Pennsylvania and at present of the Department of Commerce, Washington, D. C., reported upon "The Elimination of Waste in Industry." The meeting was devoted to a description of the methods and accomplishments of the movement for the elimination of waste in industry which is sponsored by the Department of Commerce. The speaker first described the origin of the movement and showed that it was based upon common agreement and was not in any sense brought about as an imposition upon industry by the Department of Commerce. As some of the results obtained by what is known as the "simplification programme" he cited the following: The number of types of paving bricks has been reduced from sixty-five to two, and the number of different abrasive wheels has been reduced from more than six hundred thousand to something over two hundred thousand. He also gave many other examples. He showed clearly the relief which had already been obtained and the successes which might be confidently predicted when industry came to understand the simplification programme as a pure piece of coöperation among industries.

Wednesday, March 17, 1926: Colonel E. Lester Jones, Director of the U. S. Coast and Geodetic Survey in Washington, spoke before the Institute on "Science and the Earthquake Peril." He pointed out the general distribution of earthquakes in past ages, showed the error of any fatalistic attitude of mind in accordance with which the earthquake peril must be accepted as unavoidable, and therefore not to be opposed, and also showed the increase of the earthquake peril because of the congestion of population and the types of structures erected. He recited the lessons learned from experience in earthquakes and outlined what science can do to minimize the perils and damages resulting from earthquakes. Science can collect information concerning earthquake regions and can in certain cases make crude predictions of the likelihood of earthquakes; it can aid in designing structures which will withstand the damage usually caused by earthquake tremors; it can aid in the prevention of damage by fire and loss of water supply resulting from shakings of the earth. The lecture was admirably illustrated by photographs of earthquake scenes, of the instruments used in earthquake studies, and of structures which experience shows can withstand the quakes.

Thursday, March 25, 1926: Dr. T. G. Delbridge, Supervisor, Process Division, Atlantic Refining Company of Philadelphia, was the next speaker before the Institute and read an illuminating paper upon "The Cracking of Petroleum." Doctor Delbridge explained the term 'cracking' and pointed out

its scientific and economic significance; indicated the conditions as to pressure, temperature, etc., which must be met in order to solve certain difficult problems; and discussed the possibility of the use of a catalytic agent in increasing the product of cracking. He stated there were three fundamental processes in cracking: the vapor phase process; the liquid phase process; and a catalytic process. Of these the second was used in the bulk of present-day methods, which number twenty-six in all. He outlined the varying steps of the different methods in practice, showing in much detail how these various processes differed among themselves. In conclusion he said that 'cracked' or 'synthetic' gasoline is just as good as 'straight run' gasoline and even that there was reason for the opinion that, judged by its performance, cracked gasoline is better than the 'straight run' product.

Thursday, April 1, 1926: Mr. W. A. Bentley of Jericho, Vermont, who has been photographing snow crystals for forty years, with apparatus designed and made by him, gave a remarkable display of photographs of water forms and snow flakes, which he had taken about his home in Vermont. He threw upon the screen scores of the many thousands of snow flakes which he has photographed. Some of these pictures had been taken in the immediately preceding winter and therefore represented the latest fashions in snow flakes.

Thursday, April 8, 1926: Professor H. F. Moore, of the Material Testing Laboratory of the University of Illinois, read a scholarly paper, with abundant illustrations, on "Mechanism of Fatigue Failure of Metals." He first showed what was meant by the term, illustrating by photographs some of the effects of fatigue phenomena, and then represented the methods by which such phenomena could be studied. The use of micrographs was next explained and the lessons to be learned from them were illustrated. By the aid of some very striking photographs the lecturer was able to show illustrations of the phenomena of grain growth and indicated how it entered into fatigue phenomena. He then showed by micrographs how cracks had their origin in planes of slip. He finally pointed out the means which might be used to prevent the development of faults in structures.

Thursday, April 15, 1926: Dr. H. H. Kimball read a joint paper by himself and Dr. C. F. Marvin, Chief of the Weather Bureau, United States Department of Agriculture, on "Solar Radiation and Weather Forecasting." These gentlemen had been especially urged to present a statement of the scientific principles underlying weather forecasting, and also a statement of their opinions based upon scientific developments of long range weather forecasting. The paper which was presented was written in order to comply with this request of the Secretary. The speaker of the evening first paid a tribute to the marked scientific work of Doctor Abbott of the Smithsonian Institution, and then made it clear that the Smithsonian has no part in weather forecasting as it is generally understood. He then showed the various instruments which are in use to-day for measurement of intensity of solar radiations; showed the effect of atmospheric transmission upon the value of the solar radiation which is obtained, and then summarized the calculation of the final value of the solar constant as it is based upon the data obtained. Doctor Kimball then showed the connection that would exist between variability of the solar constant and fluctuation of weather conditions. At the end of his talk the speaker

presented the arguments pro and con the belief in a variable solar constant and stated that as yet science had not succeeded in finding any basis for reliable long range forecasting.

Wednesday, April 21, 1926: Dr. L. W. McKeehan of the Bell Telephone Laboratories, Inc., New York City, lecturing under the auspices of the Bartol Research Foundation, read a paper before the Institute on "Magnetostriction." The talk was one of a series of three. A summary of the series follows:

Tuesday, April 13: "Magnetostriction in Iron, Nickel and Cobalt."

Classical experiments on change in dimensions with change in magnetization, and on change in magnetization with forcible change in dimensions. Later experiments on pure metals. The theory of continuous media. The theory of manœuvre. Experiments on single crystals of iron.

Friday, April 16: "Magnetostriction in Alloys and Compounds."

Experiments on single crystals of magnetite. Experiments on alloys, particularly on those of iron and nickel. Recent experiments on perm-alloys. The theory of atomic magnetostriction. Change in electrical resistance with magnetization and with mechanical stress.

Wednesday, April 21: "Magnetostriction in Non-Uniform Bodies."

Experiments on bodies chemically non-uniform. The preparation and behavior of bodies physically non-uniform. Internal strains. Annealing and quenching. Cold-work. Studies of crystal orientation and of its effect on magnetization.

Thursday, April 29, 1926: Mr. S. T. Williams, Chief Engineer, Victor Talking Machine Company of Camden, New Jersey, read an intensely interesting paper on "Recent Development in the Production of Sound." At the outset the speaker read an historical summary of the development of the talking machine up to comparatively recent days. He illustrated the inferior quality of the earlier machines by demonstrations with some old types, and then gave a very clear exposition of the attempts which have been made to improve the recording and reproduction of sounds, and the agencies by which this has been effected. He next illustrated his talk with the varying effects of horns of different sizes and shapes, and showed by curves the difference between sounds produced by different horns. Much of the inferior quality of earlier horns was due to the absences of the tones and overtones of the lower frequencies. Mr. Williams showed by curves the success which had been obtained in including these lower tones in the sounds produced by the most recent reproducing apparatus, and then demonstrated it by the comparative use of the talking machine of a few years ago and the most up-to-date machine. The striking difference was shown to an appreciative and enthusiastic audience.

In addition to the above described meetings, the Institute held on Friday, April twenty-third, a joint meeting with The Engineers Club, The American Society of Mechanical Engineers, Philadelphia Section, and the American Chemical Society, Philadelphia Section, in celebration of Oil and Gas Power Week. Three papers were read; one by Mr. William H. Blauvelt of New York City, on, "Power Possibilities of Coal By-Products"; the second by Mr. V. Z. Caracristi, on, "Low Temperature Carbonization"; and the third by Dr. H. W. Brooks, of Fullerton, Pa., on "Low Temperature Carbonization in Europe and America." The first speaker showed the various well-nigh

countless products which may be gotten by the distillation of coal, and reviewed the developments and improvements which have been introduced into the industry in recent years. The second speaker, Mr. Caracristi, gave in outline a description of various low temperature processes which have been tried out, and then spoke in detail of the plant which had been installed by him under the leadership of Mr. Henry Ford of Detroit. He spoke especially of the generous support which had been rendered by Mr. Ford. Doctor Brooks in closing the meeting, gave an extensive review and comparison of low temperature processes as used in America and in Europe. The meeting was felt to be a marked success and the papers to have been of high value.

The annual Medal Day exercises were held on Wednesday, May twelfth, at which the medals awarded during the year were presented. A full description of the exercises appears on pages 207 ff. of the JOURNAL of The Franklin Institute, Volume 202.

The formal presentation of the portrait of Samuel Insull to The Franklin Institute was made at a special meeting held in the Hall of the Institute on May twenty-first. The exercises are described in full on pages 223 ff. of the JOURNAL of The Franklin Institute, Volume 202.

Respectfully submitted,

HOWARD McCLENAHAN,

PHILADELPHIA, January 12, 1927.

Chairman.

REPORT OF THE COMMITTEE ON MEMBERSHIP

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1926

To the Board of Managers of The Franklin Institute:

During the fiscal year ending September 30, 1926, one hundred and four members were enrolled in all classes of membership. Resignations were received and accepted from twenty members. Deaths of twenty-five members were recorded. The detail as to elections, resignations and deaths for the year is as follows:

| | |
|--------------------|-----|
| Elections | 104 |
| Resignations | 20 |
| Deaths | 25 |

SUMMARY:

| | |
|---------------------------------------|-----|
| Elections | 104 |
| Resignations | 20 |
| Dropped for non-payment of dues | 18 |
| Deaths | 25 |

Net increase in membership

Membership of the Institute by Classes, September 30, 1926:

| | |
|----------------------------------|-----|
| Resident Members | 543 |
| Non-resident Members | 602 |
| Life Members | 189 |
| Honorary Members | 31 |
| Associate Members | 8 |
| Second-class Stock Members | 20 |

| | |
|-----------------------------|------------|
| Corresponding Members | 2 |
| Contributing Members | 54 |
| Student Members | 2 |
| | <hr/> 1451 |

From the figures above it will be noted that a considerable increase has been made in membership, and during the last three months of 1926 a great number of additional members were enrolled, a total of 35 for the three months.

By the creation of two new classes of membership during the year 1925, namely, contributing Members and Student Members, greater interest in the Institute has been awakened, which had its effect on the year 1926. A committee especially appointed in the autumn months of 1925 for the purpose of increasing the membership of the Institute and extending its usefulness prepared a circular, which gives in readable form an outline of the history of the Institute and shows what it has done for the City and State. This circular, together with a circular letter to which is attached the names of nineteen citizens of Philadelphia, was used at the booth of the Institute at the Sesqui-Centennial and given to any person desiring information concerning the activities of the Institute or the conditions of membership in it. This literature is also being sent out in response to all inquiries which come in to any of the officers concerning membership.

Nothing in the nature of a campaign for membership is being conducted, but a few members of the Board of Managers of the Institute have by personal effort obtained a considerable number of new members. It is hoped that a continuance of this activity may lead to even more successful results.

Respectfully submitted,

R. W. LESLEY,
Chairman.

PHILADELPHIA, January 12, 1927.

REPORT OF THE COMMITTEE ON FINANCE

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1926

To the Board of Managers of The Franklin Institute:

The Committee presents the following statement:

THE FRANKLIN INSTITUTE

PROPERTY AND FUNDS

| | | |
|---|----------------------|-----------------------|
| Building and Land, 13-17 South Seventh Street | \$ 60,000.00 | |
| Library | | \$160,000.00 |
| | Principal. | Unexpended Income. |
| Funds held by Board of Managers | \$651,159.34 | |
| Franklin Institute Building Fund | 586,828.15 | |
| Elliott Cresson Medal Fund | 3,000.00 | 1,181.77 |
| Franklin Fund and Building Committee.. | 18,606.79 | |
| | <hr/> \$1,259,594.28 | <hr/> \$2,762.49 |
| | | <hr/> \$1,262,356.77 |
| | | <hr/> \$1,422,356.77 |

LIABILITIES

| | |
|-----------------------------|-------------|
| Certificates of Stock | \$28,694.00 |
| Bills Payable | 54,500.00 |
| Vouchers Payable | 3,441.68 |
| Unearned Income | 112.50 |
| | <hr/> |
| | \$86,748.18 |

STATEMENT OF INCOME AND EXPENSES APPLICABLE TO THE YEAR ENDED
SEPTEMBER 30, 1926

| | | |
|--|-------------|-------------|
| Membership Dues: | INCOME | |
| Resident | \$7,800.00 | |
| Contributing | 825.00 | |
| Non-Resident | 2,905.00 | |
| Second-class Stock | 216.00 | |
| Associate | 55.00 | \$11,801.00 |
| | <hr/> | |
| Initiation Fees | | 180.00 |
| B. H. Belfield Memorial Fund | | 263.44 |
| James H. Cresson Fund | | 2,240.81 |
| General Endowment Fund | | 19,601.18 |
| John H. Towne Memorial Fund | | 182.22 |
| John H. Wahl Memorial Fund | | 4,730.87 |
| Estate of John Turner | | 157.06 |
| Estate of Robert Wright | | 2,238.26 |
| Publications—Subscriptions and Sales | \$4,053.11 | |
| Advertising | 6,112.07 | 10,165.18 |
| | <hr/> | |
| Thomson Lectures | | 1,385.77 |
| “Physics of the Air” | | 250.00 |
| Miscellaneous Income and Expense | | 681.75 |
| | | <hr/> |
| Total Income | | \$53,877.54 |
| | EXPENSES | |
| Building—Wages | \$1,887.74 | |
| Repairs and Maintenance | 510.08 | |
| Taxes, Water Rent and Insurance | 329.71 | |
| Heat, Light and Power | 796.81 | |
| Miscellaneous Supplies and Expenses | 337.47 | \$3,861.81 |
| | <hr/> | |
| Instruction, Salaries and Annuities | | 177.08 |
| Library—Salaries | \$11,371.98 | |
| Books and Periodicals | 2,035.27 | |
| Binding | 1,347.05 | |
| Miscellaneous Expense | 612.38 | 15,366.68 |
| | <hr/> | |
| Meetings | | 4,042.22 |

THE FRANKLIN INSTITUTE

89

| | | |
|--------------------------------------|-------------|-------------|
| Office and General—Salaries | \$14,115.64 | |
| Office Expense | 1,403.44 | |
| General Expense | 1,319.87 | |
| Auditor | 300.00 | 17,138.95 |
| <hr/> | | |
| Publication—Printing | \$12,461.09 | |
| Illustrating | 2,606.55 | |
| Miscellaneous Expense | 690.60 | |
| Year Book | 957.14 | |
| Reprints | 760.46 | 17,475.84 |
| <hr/> | | |
| Science and the Arts | | 4,165.32 |
| Interest and Discount | | 2,658.23 |
| Badges and Certificates | | 48.40 |
| Samuel Insull Portrait Account | | 271.14 |
| <hr/> | | |
| Total Expenses | | \$65,205.67 |
| <hr/> | | |
| Deficit | | \$11,328.13 |
| <hr/> | | |

Notwithstanding the operating deficit of \$11,328.13 as shown above, there was during the year a net increase of assets over liabilities amounting to—\$7,689.84.

THE BARTOL RESEARCH FOUNDATION

FUNDS

| | Principal. | Unexpended Income. |
|---------------------------------|----------------|-----------------------|
| Bartol Principal | \$1,268,811.41 | |
| Bartol Accumulated Income | 397,774.55 | |
| | <hr/> | <hr/> |
| | | \$1,666,585.96 |

LIABILITIES

| | |
|------------------------|------------|
| Vouchers Payable | \$8,710.07 |
|------------------------|------------|

STATEMENT OF INCOME AND EXPENSES APPLICABLE TO THE YEAR ENDED SEPTEMBER 30, 1926

INCOME

| | |
|---------------------------------|-------------|
| Bartol Principal | \$66,267.40 |
| Bartol Accumulated Income | 23,158.92 |
| Interest | 596.17 |
| <hr/> | |
| Total Income | \$90,022.49 |

EXPENSES

| | |
|---------------------------------------|------------|
| Building—Wages | \$2,333.75 |
| Taxes, Water Rent and Insurance | 133.59 |
| Heat, Light and Power | 2,518.62 |

| | | |
|--|------------|-------------|
| Supplies | 442.17 | |
| Miscellaneous Expenses | 194.14 | \$5,622.27 |
| <hr/> | | |
| Library—Salaries | \$600.00 | |
| Books and Periodicals | 739.13 | |
| Miscellaneous | .05 | \$1,339.18 |
| <hr/> | | |
| Office Expense—Salaries | \$7,653.51 | |
| Stationery and Supplies | 259.11 | |
| Miscellaneous Expenses | 717.46 | \$8,630.08 |
| <hr/> | | |
| Laboratory Supplies | | \$4,454.67 |
| Machine Shop Supplies | | 1,610.93 |
| Travelling Expenses | | 1,008.12 |
| Salaries Research Professors and Mechanics | | 11,662.29 |
| Commissions for Collection of Income | | 1,779.93 |
| Contingent Expenses | | 1,144.48 |
| Honoraria of Advisory Committee | | 2,479.13 |
| Auditor | | 325.00 |
| Lectures | | 1,155.33 |
| Publications—Printing | | 638.52 |
| <hr/> | | |
| Total Expenses | | \$41,849.93 |
| Surplus | | \$48,172.56 |
| <hr/> | | |

Respectfully submitted,

WALTON FORSTALL,
Chairman.

PHILADELPHIA, January 12, 1927.

REPORT OF THE COMMITTEE ON PUBLICATIONS

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1926

To the Board of Managers of The Franklin Institute:

Since our last report, a marked change in the appearance of the JOURNAL of The Franklin Institute was effected by the adoption of a new cover, which was first used in January, 1926, on Volume 201, Number I, and which, it is presumed, will be used indefinitely. Many favorable comments commending the Committee upon the appearance of the JOURNAL, have been received.

The most important feature of the publication of the JOURNAL of The Franklin Institute during the latest Institute year was the number of contributions made to the JOURNAL by the men working at the Bartol Research Foundation Laboratories. It is, of course, the policy of the Institute to publish in its JOURNAL all of the work of value done at the Laboratories. During the last year five such articles were printed. These articles are given the right of way in all the JOURNALS and are published without delay, immediately after they are presented by the authors of them. This is, of course, a great advantage to our own men, as they have in the JOURNAL an immediate and sure agency for publication of their work.

The Committee in charge of the Bartol Research Foundation recognizes the value of this advantage and therefore pays towards the expenses of printing of the JOURNAL a sum proportionate to the amount of printed matter from the Bartol Foundation which appears in the JOURNAL.

During the last year the Committee has considered the policy of the JOURNAL with reference to the use of the Metric System in the articles which appear in the JOURNAL. The editors and the Committee are hearty supporters of the Metric System, yet they recognize that some of our contributors are not accustomed to use the Metric System and would find it an inconvenience to have to do so. The Committee has therefore decided to accept originally contributed articles in whatever system the measurements may be expressed. In all of their own editorial comments or writings, the Metric System alone is to be used; while in references or quotations from other periodicals in which the English System is used, any measurements given are to be expressed in terms of the Metric System, with the equivalent English unit in parenthesis immediately following.

During the year a hundred and twenty-two copies of Doctor Humphreys' book, "Physics of the Air" were sold. During the same period one hundred and seventy-one copies of Dr. J. J. Thomson's "Electron in Chemistry" have been sold.

A statement of the Financial operations of the Committee for the year follows:

| JOURNAL: | EXPENSES | |
|----------------------|-------------|-------------|
| Printing | \$13,036.47 | |
| Illustrations | 2,653.70 | |
| Miscellaneous | 690.60 | |
| Year Book | 1,200.64 | |
| Reprints | 1,711.47 | |
| Total Expenses | | \$19,292.88 |

| JOURNAL: | INCOME | |
|-----------------------------|------------|-------------|
| Subscriptions | \$4,053.11 | |
| Advertising | 6,112.07 | |
| Year Book—Advertising | 243.50 | |
| Reprints—Sales | 951.01 | |
| Total Income | | \$11,359.69 |
| Net Cost | | \$7,933.19 |

It should again be pointed out that these figures of the Publications Committee account contain no portion of the dues paid by members who receive the JOURNAL, without any payment other than the annual dues. This is probably merely a matter of bookkeeping, however, as the deficit is paid out of the income of the Institute, to which the dues are credited.

Respectfully submitted,

E. H. SANBORN,
Chairman.

PHILADELPHIA, January 12, 1927.

REPORT OF THE COMMITTEE ON SCIENCE AND THE ARTS

FOR THE FISCAL YEAR ENDING JANUARY 31, 1927

To the President and Members of The Franklin Institute:

With the closing of the year 1926 the ninety-second year of the existence of the Committee on Science and the Arts ended.

The work of the Committee during this year included the investigation of seventeen cases with their final disposition and of eleven new cases which are now pending.

Seventeen awards were made as a result of these investigations. Reference to the appendix to this report will show the details of the awards.

In the death, on February 22, 1926, of Mr. William H. Thorne, the Committee on Science and the Arts lost a member who had rendered a valued service for many years. His term of membership was unusually long, preparations having been made to recognize (at the next meeting of the Committee after his death) the fiftieth anniversary of his becoming a member of the Committee.

The Sub-Committee on New Subjects and Preliminary Examination held nine stated meetings during the year at which fifty-one subjects were considered. Twelve of these were recommended for investigation and applications were received from eight of them. Eight special cases were also recommended for investigation for which no application was required. These recommendations were accepted by the General Committee and sub-committees of investigation were appointed.

The Standing Sub-Committee on Literature and The Franklin Medal met at stated times and recommended the award of two Louis E. Levy Medals for articles published in the JOURNAL during 1925, and two Franklin Medals. These recommendations were adopted and the medals and accompanying certificates were presented to the recipients by the President of the Institute at the Stated Meeting in May.

Mr. Constantin Brun, Minister of Denmark, was present to receive the Franklin Medal awarded to Professor Niels Bohr, of Copenhagen, Denmark; Dr. Samuel Rea, of Philadelphia, was present to receive the Franklin Medal awarded to him; Professor Charles S. Hastings, of Yale University, to receive the Elliott Cresson Medal. The Elliott Cresson Medal awarded to Doctor George Ellery Hale, Honorary Director of Mount Wilson Observatory, was handed, in Doctor Hale's absence, to Doctor McClenahan, Secretary of the Institute, for transmission to Doctor Hale.

In the absence of Professor Ernest G. Coker, of the University of London, Mr. Frederic Watson, British Consul General, received the Levy Medal awarded to Professor Coker, for transmission to him. The Levy Medal was also presented to Mr. Frank W. Peek, Jr., of Pittsfield, Massachusetts.

The Wetherill Medal awarded to Mr. Frank Twyman of London, England, was, in his absence, received by Mr. Watson for transmission. A second Wetherill Medal awarded to the Wagner Electric Corporation, of St. Louis, Missouri, was received by its representative, Mr. E. W. Goldsmidt.

The Longstreth Medal awarded to Mr. James J. Denny, of Schumacher, Ontario, Canada, was, in his absence, received by Mr. Watson for transmission to Mr. Denny.

Eighteen of the twenty members of the Committee whose term of membership expired in January were reelected and the following new members were elected to fill vacancies.

MR. N. W. AKIMOFF

MR. WILLIAM L. BROWN, 3RD

An outstanding event of the year was the presentation to the Institute by the United Gas Improvement Company, of a fund for the establishment of the Walton Clark Gold Medal. In presenting this fund the donors state:

"The income from this investment is to be used to provide a medal to be awarded by the Institute, not more frequently than once a year, to the author of the most notable advance in knowledge or improvement in apparatus, or in method concerning the science or the art of gas manufacture or distribution or utilization in the production of illumination, or of heat, or of power."

The first award of the Clark Medal was made to Doctor Walton Clark on the afternoon of Tuesday, December 21st. This award was made on the recommendation of the Committee on Science and the Arts in consideration of Doctor Clark's life work in the American gas industry and his distinguished and outstanding contributions to technical progress in that industry.*

Valuable service was rendered by a number of the members of the Committee in acting as members of the various juries of award at the Sesqui-Centennial International Exposition. Officials of the Exposition have expressed their appreciation.

The character of this service may be judged by the fact that Mr. James S. Rogers was made Chairman and Mr. Harold Calvert, Secretary, of the Group Jury, before which cases came for final decision.

The attendance of members at the meetings of the Committee during the last year has been exceptionally good and the coöperation given by the members to the business of the Committee is fully appreciated.

Respectfully submitted,

CLARENCE A. HALL,

Chairman.

PHILADELPHIA, January 31, 1927.

*Dr. Walton Clark, in whose honor this medal was established, is Consulting Engineer of the United Gas Improvement Company, and for the seventeen years prior to 1924 was the President of The Franklin Institute. His labors as President helped greatly to give to the Institute the standing which it has today. Because of his distinguished labors in connection with the United Gas Improvement Company, The Franklin Institute awarded to Dr. Walton Clark the first Walton Clark Medal. The award was made "in consideration of his life work in the American gas industry and his distinguished and outstanding contributions to technical progress in that industry, as a pioneer in the association of chemical and physical laboratories with the developmental work of the gas companies, by his participation through interest, suggestion and advice in the invention of a process for the complete gasification of coal, in the development of processes for operating water-gas sets, and in the institution of beneficial modifications of water-gas apparatus, by numerous articles contributed to the technical press, and by his unflinching interest in the educational progress and the all-round development of the younger men who were fortunate enough to be associated with him."

APPENDIX

Statement of the Committee's Operation from February 1, 1926,
to January 31, 1927

| | |
|---|-------|
| Cases pending February 1, 1926 | 13 |
| Applications received to January 31, 1927 | 8 |
| Special Reports | 8 |
| | <hr/> |
| | 29 |
| Disposed of to January 31, 1927 | 17 |
| Leaving pending | 12 |

AWARDS MADE

| | |
|----------------------------------|-------|
| Franklin Medal | 2 |
| Louis E. Levy Medal | 2 |
| Elliott Cresson Medal | 3 |
| Howard N. Potts Medal | 3 |
| John Price Wetherill Medal | 2 |
| Walton Clark Medal | 1 |
| Edward Longstreth Medal | 4 |
| | <hr/> |
| | 17 |

REPORT OF THE COMMITTEE ON BARTOL RESEARCH FOUNDATION

FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1926

To the President and Members of The Franklin Institute:

During the fiscal year just ended, the work of the Bartol Foundation Laboratories, which was inaugurated in September, 1925, has been continued and greatly extended.

In the autumn 1926, four additional Bartol Fellows were added to our scientific personnel, while a fifth began his researches at the end of December. Six Fellows are now actively engaged in research at the Laboratories. These Fellows with their academic records are:

DR. ARTHUR BRAMLEY: Graduate of the University of Oregon; Ph.D. Princeton University. Appointed instructor in Physics, Princeton University; resigned to accept Bartol Fellowship in September, 1925. Reappointed Fellow in September, 1926.

WAYNE B. NOTTINGHAM: Graduate of Purdue University. Benjamin Franklin Fellowship in Sweden for the year 1920-1921. For four years with the Western Electric Company (Bell Telephone Laboratories, Inc., New York City.) Fellow in Physics, Princeton University 1925-1926. Bartol Research Fellow 1926-1927.

HERBERT J., and JAMES H. BRENNEN: Graduates of McGill University. Honor Fellowships, Cambridge University. Two years Fellows in laboratory of Madame Curie, Paris; Docteurs es Sciences, University of Paris. Instructors in Chemistry, Manhattan College, 1925-1926. Bartol Fellows 1926-1927.

DONALD H. ANDREWS: Graduate of Yale University. Ph.D. Yale University. National Research Council Fellowship. One year at University of California. One year at University of Leiden. Bartol Research Fellow 1926-1927.

PROFESSOR O. E. FRIVOLD: Assistant Professor of Physics, University of Oslo, Norway. American-Scandinavian Fellow and Bartol Research Fellow 1926-1927.

These six scholars have been carrying on researches of a fundamental character and have obtained results original in character and of importance. As the advancement of the work warrants, the results obtained will be made public, in general through the JOURNAL of The Franklin Institute.

During the past year all research work has been carried on under the active advice and aid of Professor Swann of Yale University and Professor Adams of Princeton University, who have served as an Advisory Research Committee, as a substitute for a Director, and who have been at the Laboratories at least one day a week during the year. In addition to advising with the Fellows concerning their problems, both Professor Swann and Professor Adams have carried on research problems in which they were interested. The results of their work will be published in due time.

By the support of the Bartol Foundation, Professor Swann in September last went to Pike's Peak in Colorado and repeated the observations which he had made the previous summer in Norway, in a search for corpuscular radiations of cosmic origin. He spent almost a week on the top of Pike's Peak, setting up his apparatus and making his observations. This was at an elevation of approximately fourteen thousand feet. The same set of observations was then made at Colorado Springs, at an elevation of about seven thousand feet. And then, upon Professor Swann's return to New Haven, Connecticut, these observations were made at sea level. The purpose was, of course, to determine the existence of such radiations in the first place, and in the second place to discover, if possible, the quantitative influence of atmospheric absorption upon any radiations of cosmic origin which might be detected. The results of these researches are to be published shortly.

The work of the Bartol Laboratories has been carried on under the general supervision of the Bartol Research Foundation Committee, composed of Dr. W. C. L. Eglin, President of the Institute, Dr. Walton Clark, former President of the Institute; Mr. Marshall Morgan; Mr. Nathan Hayward; Mr. Charles Penrose; and Professors Swann and Adams; Dean Joseph S. Ames, Johns Hopkins University; Dr. Arthur L. Day, Director of the Geophysical Laboratory, Washington, D. C.; President C. R. Richards of Lehigh University and the Chairman, with Dr. Howard McClenahan, Secretary of the Institute serving as an advisory member and the general executive of the Committee. The work of the Foundation has been coördinated with the work of The Franklin Institute as far as possible under the administrative direction of Doctor McClenahan, and it has been found that many economies have been effected and the work greatly facilitated thereby.

An additional machinist has been added to our Machine Shop staff, making three in all, and a glass blower now working on full time has added greatly to the success of the work carried on, since such work requires much special apparatus of more or less intricate design, most of which is now being made in our shop.

The financial statement (page 89) of the Bartol Foundation shows that during the last year nearly fifty thousand dollars were added to the capital fund of the Foundation. During the preceding year a somewhat larger sum was added to the capital, so that during the past two years the invested funds of the Bartol Foundation have been increased by somewhat more than a hundred thousand dollars.

During the past year four series of lectures have been delivered on the Bartol Foundation by scientists of standing in the United States and England. Dr. E. O. Hulburt of the Naval Research Laboratory, Washington, D. C., gave three lectures on "The Kennelly-Heaviside Layer and Radio Wave Propagation"; "Hydrogen Spectrum Lines in the Stars and in the Laboratory"; "The Pressure of Light on Electrons." Dr. L. W. McKeehan of the Bell Telephone Laboratories, Inc., New York City, delivered a course of three lectures on "Magnetostriiction." Professor R. Whiddington, Cavendish Professor of Physics, University of Leeds, England, read a paper on "The Luminous Discharge Through Rare Gases." And Professor R. C. Tolman, Professor of Physical Chemistry and Mathematical Physics, California Institute of Techn-

ology, presented three papers on "Statistical Mechanics and Its Application to Physical-Chemical Problems." All of the lectures were greatly appreciated and have been published or will be published in the JOURNAL of the Institute.

In accordance with the policy of the Foundation and the Institute, eight articles appeared in the JOURNAL of the Institute from the Bartol Foundation. Three of these were by Dr. Bramley, the first Fellow; the three lectures by Dr. Hulburt; one article upon the three lectures by Dr. McKeehan; and two communications from Dr. H. J. Brennen.

Plans are under way, the completion of which will greatly facilitate and extend the work of the Foundation. In conclusion I wish to thank the individual members of the Bartol Committee for their support and unfailing interest in the progress of the work and to commend the employees of the Foundation for the loyal and cheerful performance of their duties.

Respectfully submitted,

C. C. TUTWILER,
Chairman.

PHILADELPHIA, January 12, 1927.

THE FRANKLIN INSTITUTE AWARDS

FEBRUARY 1, 1926 TO JANUARY 31, 1927

THE FRANKLIN MEDAL

TO

Professor Niels Bohr, of Copenhagen, Denmark, "in recognition of his epoch-making contributions to the mechanics of atomic structures and for the brilliant results attained by application of his theory regarding the origin of spectrum lines."

Dr. Samuel Rea, of Philadelphia, Pennsylvania, "in recognition of his outstanding work in the conception and construction of railroads, their terminals, tunnels and bridges, and of his eminently successful application of the principles of science, economics and human relations to railway engineering and administration, in which he displayed vision, imagination and courage of high order."

THE ELLIOTT CRESSON MEDAL

TO

Dr. George Ellery Hale, of Pasadena, California, in recognition of his outstanding researches and fundamental discoveries relating to the sun and the solar atmosphere.

Dr. Charles S. Hastings, of New Haven, Connecticut, in recognition of his scientific attainments and of his originality and skill in the design and computation of optical systems of the highest order.

THE LOUIS EDWARD LEVY MEDAL

TO

Professor E. G. Coker, of London, England, for his paper entitled "Photo-Elasticity" in the JOURNAL.

Mr. F. W. Peek, Jr., of Pittsfield, Massachusetts, for his paper entitled "Lightning" in the JOURNAL.

THE HOWARD N. POTTS MEDAL

TO

Dr. W. D. Coolidge, of the General Electric Company, Schenectady, New York, for his inventions embodied in the Coolidge X-ray tube.

Mr. Howard W. Matheson, of Shawinigan Falls, Canada, for his inventions embodied in his Process for the Conversion of Acetylene to Acetaldehyde and Its Oxidation to Acetic Acid.

THE JOHN PRICE WETHERILL MEDAL

TO

Dr. Carl Akeley, of New York City, N. Y., for his inventions embodied in the Akeley Motion Picture Camera.

THE WALTON CLARK MEDAL

TO

Dr. Walton Clark, of Philadelphia, Pennsylvania, in recognition of his distinguished and outstanding contributions to the technical progress of the gas industry.

THE EDWARD LONGSTRETH MEDAL

TO

Mr. James J. Denny, of Cobalt, Canada, for his inventions embodied in "Linerite," a rubber lining for grinding mills.

Mr. Alonzo G. Kinyon, of Fullerton, Pennsylvania, for his inventions embodied in the Fuller-Kinyon Conveying System for Pulverized Materials.

AWARDS

1856-1927

FRANKLIN MEDAL AWARDS

1915-1927

ARRHENIUS, SVANTE AUGUST, PH.D., M.D., D.Sc., LL.D.

"In recognition of his notable contributions to the theory of physical science which have found unprecedently extended and fruitful application in the experimental study of chemical, physical, biological and cosmic phenomena, as well as in industrial chemistry."

1920.

BOHR, NIELS, PH.D.

"In recognition of his epoch-making contributions to the mechanics of atomic structures and for the brilliant results attained by application of his theory regarding the origin of spectrum lines."

1926.

CARTY, JOHN J., D.ENG., D.Sc., LL.D., D.S.M.

"In recognition of his long-continued activities in the telephone service, his important and varied contributions to the telephone art, his work in the establishment of the principles of telephone engineering, and his signal success in directing the efforts of a large staff of engineers and scientists to the accomplishment of the telephonic transmission of speech over vast distances."

1916.

DEWAR, SIR JAMES, LL.D., D.Sc., PH.D., F.R.S.E., F.I.C., F.C.S.

"In recognition of his numerous and most important contributions to our knowledge of physical and chemical phenomena and his great skill and inventive genius in attacking and solving chemical and physical problems of the first magnitude."

1919.

EDISON, THOMAS ALVA, PH.D., D.Sc., LL.D.

"In recognition of the value of numerous basic inventions and discoveries forming the foundation of world-wide industries, signally contributing to the well-being, comfort and pleasure of the human race."

1915.

FABRY, CHARLES, D.Sc.

"In recognition of his numerous and highly important contributions in the field of physical science, particularly the solution of optical and spectroscopical problems of fundamental importance."

1921.

FRANKLIN MEDAL AWARDS

FERRIÉ, AUGUSTE GUSTAVE, GENERAL.

"In recognition of his long-continued and successful researches in the field of radio-transmission of intelligence and their splendid and successful military applications, and of his eminent success in the organization and directing of the communication service of the French Army during the World War."

1923.

LORENTZ, HENDRICK ANTOON, PH.D., F.R.S.

"In recognition of his researches which have so largely contributed to laying on a new foundation our knowledge of the nature of light and in developing our ideas concerning the ultimate constitution of matter."

1917.

MARCONI, GUGLIELMO, LL.D., D.Sc.

"In recognition of his brilliant inception and successful development of the application of magneto-electric waves to the transmission of signals and telegrams without the use of metallic conductors."

1918.

MENDENHALL, THOMAS CORWIN, PH.D., D.Sc., LL.D., F.A.G.S.

"In recognition of his fruitful and indefatigable labors in physical research, particularly his contributions to our knowledge of physical constants and electrical standards."

1918.

MICHELSON, ALBERT A., PH.D., Sc.D., LL.D.

"In recognition of his numerous and signally fruitful researches in physical science, especially his brilliant discoveries in the fields of optics and astrophysics."

1923.

MODJESKI, RALPH, D.ENG.

"In recognition of his signal achievements as a designer and a builder of structures, mainly bridges, many of them epoch-marking in the history of the engineering profession, beautiful as well as useful, involving on the part of the designer, vision, courage and technique of the highest order."

1922.

ONNES, HEIKE KAMERLINGH, PH.D., D.Sc.

"In recognition of his long-continued and indefatigable labors in low-temperature research, which have enriched physical science, not only with a great number of new methods and ingenious devices, but also with achievements and discoveries of the first magnitude."

1915.

FRANKLIN MEDAL AWARDS

PARSONS, SIR CHARLES ALGERNON, K.C.B., C.B., M.A., LL.D., D.Sc., F.R.S.

"In recognition of his epoch-marking success in the development of the steam turbine, which has revolutionized the art of steam engineering, particularly in regard to the propulsion of mercantile and naval vessels and the driving of electrical generators."

1920.

REA, SAMUEL, Sc.D., LL.D.

"In recognition of his outstanding work in the conception and construction of railroads, their terminals, tunnels and bridges, and of his eminently successful application of the principles of science, economics and human relations to railway engineering and administration, in which he displayed vision, imagination and courage of high order."

1926.

RICHARDS, THEODORE WM., A.M., Ph.D., Sc.D., LL.D., Chem.D., M.D., F.C.S.

"In recognition of his numerous and important contributions to inorganic, physical and theoretical chemistry, and particularly his classical series of redeterminations of the atomic weights of the more important chemical elements."

1916.

RUTHERFORD, SIR ERNEST, Kt., D.Sc., LL.D., Ph.D., D.Phys., F.R.S.

"In recognition of long-continued and fruitful researches, signally contributing to the present state of knowledge of the elements, their constitution and relationships."

1924.

SPRAGUE, FRANK J., D.ENG.

"In recognition of his many and fundamentally important inventions and achievements in the field of electrical engineering, notably his contributions to the development of the electric motor and its application to industrial purposes, and in the art of electric traction, signally important in forming the basis of world-wide industries and promoting human welfare."

1921.

SQUIER, GEORGE OWEN, K.C.M.G., D.S.M., Ph.D.

"In recognition of his valuable contributions to physical science, his important and varied inventions in multiplex telephony and telegraphy and in ocean cabling and his eminent success in organizing and directing the air and signal services of the U. S. Army in the World War."

1919.

TAYLOR, DAVID WATSON, D.ENG., D.S.M.

"In recognition of his fundamental contributions to the theory of ship resistance and screw propulsion and of his signal success in the application of correct theory to the practical design of varied type of war vessels in the U. S. Navy."

1917.

FRANKLIN MEDAL AWARDS

THOMSON, ELIHU, PH.D., Sc.D., LL.D.

"In recognition of his pioneer work in the field of electricity and electrical engineering and of his numerous inventions in these fields."

1925.

THOMSON, SIR JOSEPH JOHN, O.M., F.R.S., D.Sc., F.R.S.E., LL.D., PH.D.

"In recognition of the immeasurable service he has rendered to the world as teacher and leader of thought in that domain of science, especially related to a fundamental knowledge of electricity and the constitution of matter."

1922.

WESTON, EDWARD, LL.D., Sc.D.

"In recognition of discoveries and inventions in the field of electricity, immeasurably fruitful and fundamentally contributory to the establishment of the electric art."

1924.

ZEEMAN, PIETER, PH.D., Sc.D.

"In recognition of his numerous and important contributions in the field of magneto-optics and particularly of his discovery of the effect of a magnetic field upon the frequencies of the light from a radiating source."

1925.

CRESSON MEDAL AWARDS

1856-1927

ACKER, C. E.

Process of Manufacturing Caustic, etc.—1902.

ALBERT, CHARLES F.

Violins and Bows.—1887.

AMERICAN COTTON COMPANY.

Round Lap Bale System.—1901.

AMERICAN PAPER BOTTLE COMPANY.

Paper Bottles for Various Purposes.—1906.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY.

Contributions to the Modern Telephone Art.—1916.

ATWATER, W. O., and ROSA, E. B.

Respiration Calorimeter.—1900.

AUTOMATIC ELECTRIC COMPANY.

Automatic Telephony.—1910.

BAEYER, J. F. A. VON.

Research Work in Organic Chemistry.—1912.

BALDWIN LOCOMOTIVE WORKS.

Contributions to the Evolution of the American Locomotive.—1907.

BATCHELLER, C. H.

Compound Locomotive.—1893.

CRESSON MEDAL AWARDS

- BATES, STOCKTON; SHAW, EDWIN, and VON CULIN, G. M.
Spindle Support.—1891.
- BELL, ALEXANDER GRAHAM.
Electrical Transmission of Speech.—1912.
- BERLINER, EMILE.
Telephony and Sound Reproduction.—1913.
- BEVINGTON, J. H.
Welding Metal and Spinning and Shaping Tools.—1891.
- BILGRAM, HUGO.
Bevel Gear Cutter.—1887.
- BONWILL, W. G. A.
Electro-magnetic Dental Mallet.—1876.
- BORSCH, LOUIS.
Solid Invisible Bifocal Lens.—1907.
- BOWER, HENRY.
Inodorous Glycerine.—1878.
- BRASHEAR, JOHN A.
Leading Work in Astronomic Science.—1910.
- CASTNER, H. Y.
Electrolytic Process of Decomposing Alkaline Chlorides for the Production of Caustic and Chlorine.—1897.
- CHABOT, CYPRIEN.
Shoe Sewing Machine.—1885.
- CHAMBERS BROTHERS.
Bolt and Rivet Clipper.—1878.
- CHARLTON, J.
Shaft Coupling.—1876.
- CLAMER, G. H.
Methods of Eliminating Metals from Mixture of Metals.—1904.
- COOPER-HEWITT, P.
Mercury Rectifier.—1910.
- CORSCADEN, T.
All-wrought Steel Belt Pulley.—1898.
- COWLES, EUGENE H. AND ALFRED H.
Electric Smelting Furnace.—1887.
- COWPER, EDWARD A., AND ROBERTSON, T. HART.
Writing Telegraph.—1889.
- CROOKES, SIR WILLIAM.
Discoveries in Chemistry.—1912.
- CURIE, PIERRE AND MARIE.
Researches Resulting in the Discovery of Radium.—1909.
- DEFORREST, LEE.
The Audion.—1922.
- DELANDTSHERE, NORBERT.
Machine for Treating Flax.—1879.

CRESSON MEDAL AWARDS

DELANY, P. B.

Synchronous Multiplex Telegraphy.—1886.

System of Machine Telegraphy.—1896.

Telepost.—1908.

DIESEL, R.

Diesel Motor.—1901.

DODGE, J. M.

System of Storing Coal.—1904.

DUDLEY, P. H.

Dynamograph.—1877.

EDER, J. MARIA.

Researches in Photochemistry.—1914.

ELDER, BYRON E.

Low-expansion Leading-in Wire for Incandescent Electric Lamps.—1921.

EMMET, WILLIAM LEROY.

Work on Electrical Propulsion of Ships and Prime Movers.—1920.

FERRILL, J. L.

Process of Fireproofing Wood.—1903.

FISCHER, EMIL.

Contributions to Organic Chemistry.—1913.

FISKE, B. A.

Range Finder.—1892.

FISS, BARNES, ERBEN & Co.

Worsted Yarns.—1875.

FORBES, JOHN S., AND WATERHOUSE, A. G.

Art of Automatically Heating and Sterilizing Fluids.—1901.

FRITZ, JOHN.

Advancement of Steel Industries.—1910.

GAEDE, W.

Molecular Air Pump.—1909.

GANS, ROBERT.

Permutit.—1916.

GAYLEY, J.

Dry Air Blast in Blast Furnace Operation.—1909.

GILL, W. L.

School City.—1903.

GOLDSCHMIDT, HANS.

Alumino-thermics.—1904.

GOLDSCHMIDT, V.

New Theory of Musical Harmony.—1903.

GRAY, E.

Telautograph.—1897.

ORESSON MEDAL AWARDS

GRAY NATIONAL TELAUTOGRAPH COMPANY.

Telautograph.—1912.

GRISCOM, W. WOODNUT.

Electric Motor and Battery.—1881.

HADFIELD, SIR ROBERT A.

Advancement of Metallurgical Science.—1910.

HALE, GEORGE ELLERY.

Discoveries Relating to the Sun and the Solar Atmosphere.—1926.

HAMMER, W. J.

Historic Collection of Incandescent Electric Lamps.—1906.

HAMMOND, J.

Typewriter.—1890.

HASTINGS, CHARLES S.

Originality and Skill in the Design and Computation of Optical Systems.—1926.

HAUPT, L. M.

Reaction Breakwater.—1901.

HAYES, MAYER AND COMPANY.

Manufacture of Files.—1890.

HEANY, J. ALLEN.

Fireproof Insulated Wire.—1907.

HERSCHEL, CLEMENS.

Venturi Meter.—1898.

HODGKINSON, FRANCIS.

Turbo-electric Appliances.—1925.

HOLLERITH, H.

Electric Tabulating Device.—1890.

HOLMES, P. H.

Lubricant Bearing.—1892.

HOUGH, R. B.

Contributions to the Characteristics and Uses of the American Woods.—1908.

HOWE, H. M.

Experimental Research on Steel.—1895.

Metallurgy of Steel.—1892.

IVES, FREDERICK E.

Color Photography.—1893.

JENKINS, C. FRANCIS.

"Phantoscope."—1898.

JOHNSON, RAYMOND D.

Hydraulic Valve.—1923.

KINGSBURY, ALBERT.

Thrust Bearing.—1923.

CRESSON MEDAL AWARDS

- LANSTON, T.
Monotype Machine.—1896.
- LEVY, L. E.
Acid Blast Method and Apparatus for Etching Metal Plates.—1900.
Machine for Powdering Plates for Etching.—1904.
- LEWIS, COL. ISAAC NEWTON.
Machine Gun.—1918.
- LINDE, KARL P. G.
Refrigeration Processes.—1914.
- LOWE, THADDEUS S. C.
Water Gas Process and Apparatus.—1886.
- LOVEKIN, L. D.
Expanding and Flanging Machinery and Tools for all Classes of Tubes.—1904.
- LUMIÈRE, AUGUSTE AND LOUIS.
Color Photography.—1909.
- MALLET, A.
Articulated Compound Locomotive.—1908.
- MARKS, G. E.
Improvements in Artificial Limbs.—1893.
- MASON AND HAMLIN COMPANY.
Liszt Organ.—1901.
- MERGENTHALER, O.
Linotype.—1889.
- MICHELSSEN, A. A.
Work in Physical Optics.—1912.
- MILLER, DAYTON C.
Fundamental Investigations in Acoustics.—1926.
- MOISSAN, HENRI.
Investigations with the Electric Furnace.—1898.
- MORLEY, E. W.
Determination of Fundamental Magnitudes in Chemistry.—1912.
- NOBLE, ALFRED.
Achievements in Civil Engineering.—1912.
- NORTHRUP, EDWIN F.
Electric Furnace and High Temperature Investigations.—1917.
- OLSEN, TINIUS.
Testing Machine.—1891.
- OTT AND BREWER.
China and Porcelain Wares.—1886.
- OUTERBRIDGE, A. E., JR.
Molecular Structure of Cast Iron.—1904.

CRESSON MEDAL AWARDS

GRAY NATIONAL TELAUTOGRAPH COMPANY.

Telautograph.—1912.

GRISCOM, W. WOODNUT.

Electric Motor and Battery.—1881.

HADFIELD, SIR ROBERT A.

Advancement of Metallurgical Science.—1910.

HALE, GEORGE ELLERY.

Discoveries Relating to the Sun and the Solar Atmosphere.—1926.

HAMMER, W. J.

Historic Collection of Incandescent Electric Lamps.—1906.

HAMMOND, J.

Typewriter.—1890.

HASTINGS, CHARLES S.

Originality and Skill in the Design and Computation of Optical Systems.—1926.

HAUPT, L. M.

Reaction Breakwater.—1901.

HAYES, MAYER AND COMPANY.

Manufacture of Files.—1890.

HEANY, J. ALLEN.

Fireproof Insulated Wire.—1907.

HERSCHEL, CLEMENS.

Venturi Meter.—1898.

HODGKINSON, FRANCIS.

Turbo-electric Appliances.—1925.

HOLLERITH, H.

Electric Tabulating Device.—1890.

HOLMES, P. H.

Lubricant Bearing.—1892.

HOUGH, R. B.

Contributions to the Characteristics and Uses of the American Woods.—1908.

HOWE, H. M.

Experimental Research on Steel.—1895.

Metallurgy of Steel.—1892.

IVES, FREDERICK E.

Color Photography.—1893.

JENKINS, C. FRANCIS.

"Phantoscope."—1898.

JOHNSON, RAYMOND D.

Hydraulic Valve.—1923.

KINGSBURY, ALBERT.

Thrust Bearing.—1923.

CRESSON MEDAL AWARDS

- LANSTON, T.
Monotype Machine.—1896.
- LEVY, L. E.
Acid Blast Method and Apparatus for Etching Metal Plates.—1900.
Machine for Powdering Plates for Etching.—1904.
- LEWIS, COL. ISAAC NEWTON.
Machine Gun.—1918.
- LINDE, KARL P. G.
Refrigeration Processes.—1914.
- LOWE, THADDEUS S. C.
Water Gas Process and Apparatus.—1886.
- LOVEKIN, L. D.
Expanding and Flanging Machinery and Tools for all Classes of Tubes.—
1904.
- LUMIÈRE, AUGUSTE AND LOUIS.
Color Photography.—1909.
- MALLET, A.
Articulated Compound Locomotive.—1908.
- MARKS, G. E.
Improvements in Artificial Limbs.—1893.
- MASON AND HAMLIN COMPANY.
Liszt Organ.—1901.
- MERGENTHALER, O.
Linotype.—1889.
- MICHELSSEN, A. A.
Work in Physical Optics.—1912.
- MILLER, DAYTON C.
Fundamental Investigations in Acoustics.—1926.
- MOISSAN, HENRI.
Investigations with the Electric Furnace.—1898.
- MORLEY, E. W.
Determination of Fundamental Magnitudes in Chemistry.—1912.
- NOBLE, ALFRED.
Achievements in Civil Engineering.—1912.
- NORTHRUP, EDWIN F.
Electric Furnace and High Temperature Investigations.—1917.
- OLSEN, TINIUS.
Testing Machine.—1891.
- OTT AND BREWER.
China and Porcelain Wares.—1886.
- OUTERBRIDGE, A. E., JR.
Molecular Structure of Cast Iron.—1904.

ORESSON MEDAL AWARDS

- OWENS, MICHAEL J.
Bottle Blowing Machine.—1915.
- PARKER, J. C.
Steam Generator.—1902.
- PECKOVER, J.
Stone Sawing Machine.—1895.
- PELTON, LESTER A.
Water Wheel.—1894.
- PENCOYD IRON WORKS.
Bridge Construction.—1900.
- PHILLIPS, F.
Pressed Steel Pulley for Power Transmission.—1907.
- POWERS AND WEIGHTMAN.
Exhibit at The Franklin Institute Exhibition of 1874.—1875.
- PRATT AND WHITNEY COMPANY.
System of Interchangeable Cut Gears.—1886.
- PUPIN, M. I.
Art of Reducing Attenuation of Electrical Waves and Apparatus.—1905.
- RAMSAY, R. H.
Railway Car Transfer Apparatus.—1886.
- RAMSAY, SIR WILLIAM.
Discoveries in Chemistry.—1913.
- RANDOLPH, ISHAM.
Achievements in Civil Engineering.—1913.
- RAYLEIGH, LORD.
Researches in Physical Science.—1913.
- ROBERTSON, T. HART, and COWPER, ED. A.
Writing Telegraph.—1889.
- ROENTGEN, W. C.
Investigations of a New Kind of Ray.—1897.
- ROSCOE, SIR H. E.
Researches in Chemistry.—1912.
- RUTHERFORD, SIR ERNEST.
Advancement of Knowledge of Electrical Theory.—1910.
- SAUVEUR, A.
Metallography of Iron and Steel.—1910.
- SHAW, EDWIN; BATES, STOCKTON; VON CULIN, G. M.
Spindle Support.—1891.
- SHAW, THOMAS.
Automatic Device for Testing Mine Gases and System of Mine Signaling.—1887.
- SIMONDS, G. F.
Universal Rolling Machine.—1889.
- SMITH, EDGAR F.
Work in Electrochemistry.—1914.

CRESSON MEDAL AWARDS

- SPELLIER, LOUIS H.
Time Telegraph.—1881.
- SPRAGUE, F. J.
Multiple Unit System of Electric Traction.—1903.
- SQUIER, MAJOR GEO. OWEN.
Multiplex Telephony.—1912.
- STEINMETZ, C. P.
Application of Analytics to Electrical Engineering.—1913.
- STRATTON, S. W.
Leading Work in Metrology.—1912.
- TALBOT, B.
Open Hearth Steel Process.—1909.
- TATHAM, W. P.
Printing Press.—1875.
- TAYLOR, E. R.
Electric Furnace and Process of Manufacturing Bisulphide of Carbon.—1907.
- TAYLOR, FREDERICK W., AND WHITE, MAUNSEL.
Process of Treating Tool Steel.—1902.
- TESLA, NIKOLA.
Alternating Electric Currents of High Frequency.—1894.
- THOMSON, ELIHU.
Industrial Applications of Electricity.—1912.
- THOMSON, JOSEPH J.
Leading Work in Physical Science.—1910.
- TILGHMAN, B. C.
Sand Blast.—1875.
- TURNER, W. V.
Air Brake Design and Application.—1909.
- U. S. GEOLOGICAL SURVEY.
Exhibit of Survey.—1900.
- UNDERWOOD TYPEWRITER COMPANY.
Typewriter.—1909.
- VAUCLAIN, S. M.
Compound Locomotive.—1891.
- VERNAZ, ALEXIS.
Milling Files.—1909.
- VON CULIN, G. M.; BATES, STOCKTON; SHAW, E.
Spindle Support.—1891.
- WALKUP, L.
Air Brush.—1886.
- WATERHOUSE, A. G., AND FORBES, JOHN S.
Art of Automatically Heating and Sterilizing Fluids.—1901.

CRESSON MEDAL AWARDS

- WELSBACH, CARL AUER VON.
Incandescent Mantles.—1901.
- WESTON, EDWARD.
Leading Work in Electrical Discovery and Application.—1910.
- WHITE, MAUNSEL, AND TAYLOR, FREDERICK W.
Process of Treating Tool Steel.—1902.
- WILCKES, J.
"Econometer."—1898.
- WILEY, HARVEY W.
Leading Work in Agricultural Chemistry.—1910.
- WOOD, H. A. WISE.
Autoplate Machine.—1909.
- WRIGHT, ORVILLE.
Work in Aviation.—1914.
- YANKO, PAUL VON.
Piano Keyboard.—1893.
- ZENTMAYER, JOSEPH.
Microscopes and Objectives.—1875.

POTTS MEDAL AWARDS

1911-1927

- ANDERSON, JOHN A.
Work in Spectroscopy and his Seismograph.—1924.
- BARKER, WENDELL A.
Wrenchless Chuck.—1920.
- BEGGS, GEORGE E.
Method and Apparatus for Determining Stresses.—1926.
- BIZZELL, JAMES A., AND LYON, T. L.
"Plants and Relation to Nitrate in Soils" (Paper).—1912.
- BONE, WILLIAM A.
"Surface Combustion" (Paper).—1913.
- BULLARD, EDWARD P., JR.
Mult-Au-Matic Machine Tool.—1920.
- COBLENTZ, W. W.
"Reflecting Power of Metals" (Paper).—1911.
- COKER, E. G.
Method of Determining Stress by Photo-elastic Means.—1922.
- COOLIDGE, W. D.
X-ray Tube.—1926.
- DAHLGREN, ULRIC.
"The Production of Light by Animals" (Paper).—1917.
- DOWNES, CHARLES RAYMOND, AND WEISS, JOHN MORRIS.
Vapor Phase Oxidation of Benzene to Maleic Acid.—1922.

POTTS MEDAL AWARDS

GAERTNER, WILLIAM.

Design and Manufacture of Scientific Instruments.—1923.

GRAY, ALEXANDER.

"Modern Dynamo Electric Machinery" (Paper).—1918.

HULL, ALBERT W.

"The Crystal Structure of the Common Elements" (Paper).—1923.

HUMPHREYS, WILLIAM J.

"The Thunderstorm and Its Phenomena" (Paper).—1915.

JANNEY, REYNOLD, AND WILLIAMS, HARVEY D.

Hydraulic Speed Gear.—1919.

KENNELLY, A. E.

Linear Hot-wire Anemometer.—1918.

KING, LOUIS V.

Improvement in Linear Hot-wire Anemometers.—1918.

LANDRETH, CLARENCE P.

Direct Oxidation Process.—1919.

LYON, T. L., AND BIZZELL, JAMES A.

"Plants and Relation to Nitrate in Soils" (Paper).—1912.

MATHESON, HOWARD W.

Process for the Conversion of Acetylene.—1926.

MCCOLLUM, E. V.

"Nutrition and Physical Efficiency" (Paper).—1921.

MODJESKI, RALPH.

"Design of Large Bridges with Special Reference to Quebec Bridge" (Paper).—1914.

MOORE, RICHARD B.

"Helium, its History, Properties and Commercial Development" (Paper).—1922.

MURRAY, W. S.

"Conditions Affecting the Success of Main Line Electrification" (Paper).—1916.

TATE, ALFRED O.

Electrolytic Waterproofing of Textile Fabrics.—1921.

WEISS, JOHN MORRIS, AND DOWNS, CHARLES RAYMOND.

Vapor Phase Oxidation of Benzene to Maleic Acid.—1922.

WILLIAMS, HARVEY D., AND JANNEY, REYNOLD.

Hydraulic Speed Gear.—1919.

WILSON, C. T. R.

Making the Tracks of Ionizing Rays Visible and Capable of Permanent Record by Photography.—1925.

LEVY MEDAL AWARDS

1924-1927

COKER, E. G.

"Photoelasticity."—1926.

FLETCHER, HARVEY.

"Physical Measurements of Audition and Their Bearing on the Theory of Hearing."—1924.

HAYES, HARVEY C.

"Measuring Ocean Depths by Acoustical Methods."—1925.

PEEK, F. W.

"Lightning."—1926.

WALTON CLARK MEDAL AWARDS

1926-1927

CLARK, WALTON.

Distinguished Contributions to the Gas Industry, Especially the Association of Chemical and Physical Laboratories with the Developmental Work of the Gas Companies.—1926.

WETHERILL MEDAL AWARDS

1925-1927

AKELEY, CARL.

Motion Picture Camera.—1926.

NORTHEAST ELECTRIC COMPANY.

Electric Power Drive for Typewriters.—1926.

TWYMAN, FRANK.

Inventions Embodied in the Hilger Interferometer.—1925.

WAGNER ELECTRIC CORPORATION.

The Fynn-Weichsel Motor.—1925.

LONGSTRETH MEDAL AWARDS

1890-1927

ABBE, C.

"Meteorology" (Paper).—1913.

ABBOTT, ROBERT R.

"Modern Steels and Their Heat Treatment" (Paper).—1916.

ACHARD, F. H., KENNELLY, A. E., AND DANA, A. S.

"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—1917.

ADAMS, L. H., AND WILLIAMSON, E. D.

"The Annealing of Glass" (Paper).—1921.

LONGSTRETH MEDAL AWARDS

- ADAMS, W. G., AND FORBES, J. S.
Stop Valve for Radiators.—1893.
- ALEXANDER, JOHN E.
"Phonosphere."—1905.
- ALTENEDER, THEODORE, AND SONS.
Drawing Pen.—1905.
- ARMSTRONG, WM. T., AND COX, JACOB D.
Grip Socket.—1896.
- ARNOLD, B. J.
Magnetic Clutches and System of Electric Power Station Construction.—1903.
- AUSTIN, JOHN T.
Austin Organ.—1917.
- BALL, JOHN D.
"Investigations of Magnetic Laws for Steel and Other Materials" (Paper).—1917.
- BASKERVILLE, C.
"Chemistry of Anæsthetics" (Paper).—1912.
- BATES, E. G.
Typographic Numbering Machine.—1895.
- BAUSH, CHRISTIAN H.
Radial Drilling Machine.—1894.
- BECKER, CHRISTOPHER A.
Chainomatic Balance.—1917.
- BENNETT, CHARLES A.
Typewriter.—1909.
- BERGONIE, J.
Use of A. C. Electro-magnet in Surgery.—1921.
- BLOEDE, V. G.
Process of Tinting Fabrics.—1894.
- BONNELL, RUSSELL, AND SCHMITT, HENRY J.
Gate Valves.—1901.
- BRADBURN AND PENNOCK.
Process of Obtaining Alumina from Bauxite.—1893.
- BRANDT, EDWARD J.
Automatic Cashier.—1922.
- BREED, G.
Apparatus for Producing Musical Sounds by Electricity.—1908.
- BRISTOL, W. H.
Recording Pressure Gauge.—1894.
- BROWN, HAROLD P., AND EDISON, THOMAS A.
Rail Bonds and Electrical Contacts.—1899.
- CAFFEY, C. S., AND COMPANY.
Improvement in Carriages and Wagons.—1900.

LONGSTRETH MEDAL AWARDS

- CARTY, J. J.
Bridging Bell System.—1905.
- CHAFFEE, E. L.
"Continuous Electric Oscillations" (Paper).—1913.
- CHANCE, E. M.
"Pathogenic Mine Atmospheres" (Paper).—1912.
- CHANCE, THOMAS M.
Apparatus for Separating Materials of Different Specific Gravities.—1925.
- CHENEY, W. L.
Lathe Tool and Support.—1895.
- CHENOWETH, A. C.
Method of Constructing Sewers.—1892.
- CLARK, WM. H., AND COLLINS, FRANK W.
Ventilating Stove.—1894.
- COLLINS, FRANK W., AND CLARK, WM. H.
Ventilating Stove.—1894.
- COLT'S PATENT FIRE ARMS MANUFACTURING COMPANY.
Automatic Pistols.—1906.
- COOPER, W. S.
Specimens of Aluminum Castings.—1895.
- COX, JACOB D., AND ARMSTRONG, WM. T.
Grip Socket.—1896.
- CREIGHTON, H. JERMAIN.
"The Deteriorating Action of Salt and Brine on Reinforced Concrete"
(Paper).—1918.
- CRISFIELD, J. A. P.
Moisture Determinator for Coke and the Like.—1909.
- CUMMINGS, H. H.
Speed Controllers.—1903.
- CUSHMAN, ALLERTON S.
"Researches on the Corrosion of Iron and Steel" (Paper).—1908.
- DANA, A. S., KENNELLY, A. E., AND ACHARD, F. H.
"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—
1917.
- DENNY, JAMES J.
Rubber Lining for Grinding Mills.—1926.
- DESHLER, CHARLES, AND McALLISTER, EDWARD J.
Portable Photometer.—1900.
- DEVoe, W. R.
Conduit Electric Railway.—1894.
- DODGE, WALLACE H.
Wooden Split Pulley.—1891.
- DOOLITTLE, T. B.
Hard Drawn Copper Wire.—1898.
- DRAPER, C. W.
Computing Machine with Indicating and Registering Mechanism.—1904.

LONGSTRETH MEDAL AWARDS

- EBERHARDT, HENRY F., AND ULRICH, F. L.
Radial Gang Cutter.—1904.
- EDDISON, WILLIAM BARTON.
Jet Entraining Apparatus.—1921.
- EDISON, THOMAS A., AND BROWN, HAROLD P.
Rail Bonds and Electrical Contacts.—1899.
- EDWARDS, LEVI TALBOT.
Compound Air-Lift System.—1918.
- ELLIOTT, WILLIAM SWAN.
Process and Apparatus for the Deaeration of Liquids.—1924.
- ELLIS, CARLETON.
Paint and Varnish Remover.—1916.
- EVE, A. S.
"Modern Views on the Constitution of the Atom" (Paper).—1916.
- FAY, C. N.; SHOLES, Z. G., AND HOCHKLASSEN, H.
Typewriting Machine.—1901.
- FOLLETT, W. I.
Time Stamp.—1906.
- FOLMER AND SCHWING MFG. COMPANY.
Graflex Cameras.—1905.
- FORBES, J. S., AND ADAMS, W. G.
Stop Valve for Radiators.—1893.
- FREAS, SAMUEL T.
"Interlocking" Tooth Saw.—1922.
- FRICK, FRED.
Electric Program Clock.—1899.
- FULLER, G. W.
"Biochemical and Engineering Aspects of Sanitary Water Supply"
(Paper).—1916.
- GOLDMAN, HENRY.
Arithmachine.—1901.
- GOODYEAR, CHARLES.
Projection Lantern.—1895.
- GRANBERY, J. H.
Stadia Rod.—1909.
- HARTNESS, JAMES.
Screw Thread Comparator.—1922.
- HEILPRIN, A.
Improved Ventilating Car Window.—1897.
- HENNING, G. C.
Pocket Recorder for Tests of Materials.—1899.
- HEPBURN, J. S.
"Chemistry of Sugar" (Paper).—1911.

LONGSTRETH MEDAL AWARDS

HERR, H. T.

"Development of Steam Turbines" (Paper).—1914.

HICKS, THOMAS WILLING.

"Once-Over" Tiller.—1922.

HILL, F. B.

Improvement in the Treatment of Sewage.—1893.

HIRSCH, H. H.

Electric Safety Lamp.—1914.

HITE, B. H.

Sterilization by High Pressure.—1920.

HOADLEY, H. G.; WILLIAMS, H. D.; AND LEWIS, E. C.

Lever and Ratch Attachment.—1900.

HOCHKLASSEN, H.; FAY, C. N.; AND SHOLES, Z. G.

Typewriting Machine.—1901.

HOKE, WILLIAM E.

Precision Gauge Blocks.—1925.

HOLLINGSHEAD, W. B.

Automatic Disinfectant Ejector.—1898.

HOLMAN, A. J., AND COMPANY.

Self-Pronouncing Bibles.—1900.

HOOVEN, OWENS, RENTSCHLER CO.

Hooven Automatic Typewriter.—1917.

HUMPHREYS, W. J.

"Volcanic Dust, Climatic Changes and Ice Ages" (Paper).—1914.

HYDE, E. P.

"Physical Production of Light" (Paper).—1911.

INTERNATIONAL LIGHT, HEAT AND POWER COMPANY.

Incandescent Lamp.—1901.

INTERNATIONAL MONEY MACHINE COMPANY.

Money Machine.—1917.

IVES, F. E.

Photo-micrographic Process.—1903.

IVES, H. E.

"Artificial Daylight" (Paper).—1915.

Improvements in Diffraction Color Photographs and Mode of Making Same.—1907.

IVES, H. E.; KINGSBURY, E. F.; AND KARRER, E.

"The Physics of the Welsbach Mantle" (Paper).—1919.

IVINS, E.

Product of Tube Making.—1894.

JOHNSTON, A. L.

Automatic Safe Electric Disconnecter.—1894.

JONES, H. C.

"Nature of Solution" (Paper).—1913.

LONGSTRETH MEDAL AWARDS

- JONES, J. R.
Machine for Rolling Car Wheels.—1892.
- KARNS, J. P., COMPANY.
Tunneling Machine.—1909.
- KARRER, E.; KINGSBURY, E. F.; AND IVES, H. E.
"The Physics of the Welsbach Mantle" (Paper).—1919.
- KELLER, JOSEPH F.
Automatic Die Cutting Machine.—1922.
- KEMP, W. W., AND VAN HORN, W. H.
Gas System.—1919.
- KENNELLY, A. E.; ACHARD, F. H.; AND DANA, A. S.
"Experimental Researches on the Skin Effect in Steel Rails" (Paper).—1917.
- KINGSBURY, E. F.; KARRER, E.; AND IVES, H. E.
"The Physics of the Welsbach Mantle" (Paper).—1919.
- KINKEAD MANUFACTURING COMPANY.
Apparatus for Aligning and Levelling Shafting.—1914.
- KINYON, ALONZO G.
Conveying System for Pulverized Materials.—1926.
- KITSON, A.
System of Oil Heating and Incandescent Lighting.—1901.
- KNAPP, I. N.
"Natural Gas" (Paper).—1913.
- KOTHNY, G. L., AND SUCZEK, ROBERT.
Radojet Air Pump.—1920.
- KROLL, G.
Convertible Carriage.—1896.
- LAIRD, SCHOBBER AND COMPANY.
General Excellence in Manufacturing Shoes.—1900.
- LATHROP, E., AND SCHREINER, O.
"Organic Constituents in Soil" (Paper).—1912.
- LEDoux, J. W.
Fluid Meter.—1919.
- LEEDS, MORRIS E.
Recording Devices.—1920.
- LENKER, WILL G.
L-E-Vation Rod.—1915.
- LEVY, MAX.
Counting Chamber for Haemocytometer.—1917.
- LEWIS, E. C.; WILLIAMS, H. D.; AND HOADLEY, H. G.
Lever and Ratch Attachment.—1900.
- LEWIS, JOHN F., AND MATTES, WM. F.
Locomotive Cylinder Lubricator.—1894.
- LEWIS, W.
Inertia Indicator.—1899.
Shockless Jarring Machine.—1926.

LONGSTRETH MEDAL AWARDS

LLOYD, M. G.

"Magnetic Hysteresis" (Paper).—1911.

LODGE, GEORGE.

Electro-magnetic Street Railway System.—1896.

LUCKIESH, M.

"The Visibility of Airplanes" (Paper).—1920.

LUPTON, D., SON AND COMPANY.

Automatic Closing Fireproof Metal Window.—1904.

MACKAY, WILLIAM M.

Operating Valve.—1893.

MCALLISTER, E. J., AND DESCHLER, CHARLES.

Portable Photometer.—1900.

MCBRIDE, THOMAS C.

Locomotive Feed Water Heater.—1924.

MARSH, E. B.

Metallic Corner Bead.—1897.

MATTES, WILLIAM F., AND LEWIS, J. F.

Locomotive Cylinder Lubricator.—1894.

MEEKER, G. H.

New Apparatus and Method in Clinical Chemistry.—1906.

MELOCHE, DANIEL H.

Molds.—1925.

MENLO PARK CERAMIC WORKS.

Decorative Tile and Faience Work.—1890.

MIDGLEY, THOMAS, JR.

Optical Indicator.—1925.

MILEY, HENRY M. AND MICHAEL.

Color Photography.—1905.

MILLER, DAYTON C.

"A 32-Element Harmonic Synthesizer" (Paper).—1917.

MOORE, RICHARD B.

"Biography of Sir William Ramsay" (Paper).—1919.

MORSELL, W. F. C.

Sectional Models for Stereometric Representation.—1903.

NACHOD, CARL P.

Electric Railway Signal System.—1924.

NOISELESS TYPEWRITER COMPANY.

Typewriter.—1922.

NORTHRUP, E. F.

"Vortex Motion in Liquids" (Paper).—1912.

PANTASOTE LEATHER COMPANY.

"Pantasote."—1896.

PARKE, HARRY S.

Pneumercator Tank and Draft Gauge.—1923.

LONGSTRETH MEDAL AWARDS

PFUND, A. H.

Colorimeter, Cryptometer, Paint Film Gauge and Rotating Sector.—1922.

PHILADELPHIA CREMATION SOCIETY.

System of Cremation.—1892.

PITKIN, A. J.

Compound Locomotive.—1891.

PITTLER, J. W. VON.

Turret Lathe.—1903.

PRESTWICH, JOHN ALFRED.

Fluid Gauge.—1918.

RANKIN, GEORGE A.

"Portland Cement" (Paper).—1917.

RECKLINGHAUSEN, M. VON.

"Ultra-violet Rays" (Paper).—1915.

REESE, B. D.

Dirigible Balloon.—1910.

REEVES, MILTON O.

Variable Speed Countershaft.—1900.

REGAN, H. C., JR.

Closed Conduit Electric Railway.—1897.

RICHARDS, G. M.

Automatic Fluid Pressure Friction Clutch.—1897.

RIKER, C. L.

Lavatory.—1900.

RINGLAND, ALBERT, AND SCHOENFUSS, F. H.

Portable Brinell Meter.—1917.

ROBY, HENRY W.

Screw Jack.—1891.

ROEDER, J. R.

Improvement in Windows.—1892.

ROPER, CHARLES.

Safety Propellers.—1909.

ROSENDAL BELTING COMPANY.

Camel Hair Belting.—1893.

ROUSSEL, W. J.

Cipher Code System.—1902.

RUSBY, J. M.

"Industrial Combustible Gases" (Paper).—1914.

RUSHTON, K.

Improvements in Trailing Trucks for Locomotives.—1910.

RUUD, EDWIN.

Instantaneous Automatic Water Heater.—1904.

SCHEMERHORN, W. GEORGE.

Folding Boat.—1891.

SCHLINK, FREDERICK J.

Stabilized Platform Weighing Scale.—1919.

LONGSTRETH MEDAL AWARDS

- SCHMIDT, MAX, AND SIEBER, JOSEPH.
Movable Sidewalk.—1894.
- SCHMIDT, HENRY J., AND BONNELL, RUSSELL.
Gate Valves.—1901.
- SCHOENFUSS, FRANK H., AND RINGLAND, ALBERT.
Portable Brinell Meter.—1917.
- SCHREINER, O., AND LATHROP, E.
"Organic Constituents in Soils" (Paper).—1912.
- SCRIPTURE, E. W.
Color Sense Tester.—1903.
- SEITZ, HENRY JEROME.
Coal Loading and Screening Machines.—1904.
- SHARPLES SPECIALTY COMPANY.
Super-Centrifuge.—1916.
- SHAW, H. M.
Lightning Arrester.—1904.
- SHEEN, MILTON ROY.
Expansion Machine for Tunnel Construction.—1924.
- SHELLENBACH, WILLIAM L.
Variable Speed Countershaft.—1903.
- SHOLES, Z. K.; FAY, C. N.; AND HOCHKLASSEN, H.
Typewriting Machine.—1901.
- SIEBER, JOSEPH, AND SCHMIDT, MAX E.
Movable Sidewalk.—1894.
- SKINNER, JOSHUA J.
"Soil Aldehydes" (Paper).—1919.
- SMATHERS, FRANK W.
Power Drive for Typewriters.—1926.
- SNOOK, HOMER CLYDE.
X-Ray System.—1919.
- SOCIÉTÉ GENEVOISE.
Measuring Machine.—1923.
- SPITZGLASS, JACOB M.
Republic Flow Meter.—1921.
- STAR BRASS MANUFACTURING COMPANY.
Steam Gauge.—1894.
- STEARNS MANUFACTURING COMPANY.
Automatic High Speed Engine.—1892.
- STONE, JOHN STONE.
"Propagation of Electric Waves along Wires" (Paper).—1913.
- STRADLING, GEORGE F.
"Modern Theories of Magnetism" (Paper).—1916.
- STUMPF, J.
Una Flow Steam Engine.—1909.
- SUCZEK, ROBERT, AND KOTHNY, G. L.
Radojet Air Pump.—1920.

LONGSTRETH MEDAL AWARDS

- TAINTOR, C. C.
Positive Saw-Set.—1895.
- TAUSSIG, JOHN H., AND ZEEK, CHARLES F.
Automatic Operation of Water Gas Sets.—1918.
- TEAL, B. F.
Anti-friction Universal Joint for Shafting.—1909.
- THOMAS, C. C.
"Measurement of Gases" (Paper).—1912.
- TIERNAN, MARTIN F., AND WALLACE, C. F.
Chlorinator.—1922.
- TOERRING, C. J.
Electric Arc Lamp.—1903.
- TOWNSEND, T. F.
Improved Thermometer Support.—1907.
- TUCKER, W. H.
Letter and Document Files.—1900.
- TURNER, W. V.
"Locomotive Air-brake" (Paper).—1911.
- TUTWILER, C. C.
"Recovery of Gas Works By-products" (Paper).—1915.
- ULRICH, FREDERICK L., AND EBERHARDT, H. E.
Radial-Duplex Gang Cutters.—1904.
- UNDERWOOD, JOHN, AND COMPANY.
Combined Calculating and Typewriting Machine.—1915.
- VAN ALLER, TYCHO.
Calorizing Process.—1918.
- VAN HORN, WILLIAM H., AND KEMP, WILLIAM W.
Kemp Gas System.—1919.
- WAGGNER, B. G.
Prepayment Gas Meter.—1916.
- WAGNER ELECTRIC MANUFACTURING COMPANY.
Single Phase Alternating Current Power Motor.—1902.
- WAHL ADDING MACHINE COMPANY.
Adding Machine.—1916.
- WALLACE, C. F., AND TIERNAN, MARTIN F.
Chlorinator.—1922.
- WATERBURY TOOL COMPANY.
Double Universal Joint.—1904.
- WEIDLOG, CHARLES B.
Indicator for Boring Machines.—1906.
- WELSBACH LIGHT COMPANY.
Various Manufactured Products.—1901.
- WENTWORTH, C. C.
Improvements in Hydraulic Rams.—1903.

LONGSTRETH MEDAL AWARDS

WETHERILL, HENRY EMERSON.

New Physical Diagnostic Instruments.—1906.

WHEELER, GEORGE A.

Step Type Escalator.—1914.

WHITE, J. J.

Journal Box.—1891.

WHITEHEAD, J. B.

"The Electric Strength of Air and Methods of Measuring High Voltage"
(Paper).—1918.

WILLIAMS, BROWN AND EARLE.

Kerosene Lamp for Magic Lanterns.—1902.

WILLIAMS, H. D.; HOADLEY, H. G.; AND LEWIS, E. C.

Lever and Ratch Attachment.—1900.

WILLIAMSON, E. D., AND ADAMS, L. H.

"The Annealing of Glass" (Paper).—1921.

YAWMAN AND ERBE MANUFACTURING COMPANY.

Rapid Roller Copier.—1904.

YOUNG, C. D.

"Locomotive Superheaters" (Paper).—1915.

ZEK, CHARLES F., AND TAUSSIG, JOHN H.

Automatic Operation of Water Gas Sets.—1918.

ZIMMERMANN, WILLIAM F.

Hob for Worm Gears.—1924.

CERTIFICATE OF MERIT AWARDS

1885-1926

BAYLIS, R. N.

Brush Holder and Brusher for Dynamos.—1909.

BEIN, EMIL J.

Letter and Document Files.—1900.

BINGHAM, EUGENE C.

Viscometer.—1922.

BLANTON, E. A., JR.

Shaft Coupling, Nut Locks, Cams, etc.—1910.

BLONCK, W. A.

Boiler Efficiency Meter.—1914.

BLOUNT, EUGENE I., AND TAYLOR, WARREN H.

Door Check.—1902.

BRANCH, C. J.

Electric Light Shade.—1909.

BULLARD, REAR-ADMIRAL W. H. G.

"The Application of Radio to Navigation Problems" (Paper).—1922.

BYERLY, F. E.

Cutter and Cutter Head.—1893.

CERTIFICATE OF MERIT AWARDS

- CANDEE, C. H.
Car Truck and Journal Bearings.—1887.
- COOK, J. S.
Self-Lubricating Journal Box.—1898.
- COPPAGE, B. DENVER.
Plastometer.—1925.
- DEMPSTER, J. T. H.; FLEMING, RICHARD; GENERAL ELECTRIC COMPANY;
AND STEINMETZ, C. P.
Magnetite Lamp.—1908.
- DERYCKE, J.
Steam Separator.—1894.
- DODGE, W. W.
Wooden Split Pulley.—1885.
- DUNN, G. S.
Automatic Electric Brake Motor.—1902.
- ELLSWORTH, F. G.
The Knudson and Ellsworth Telephone.—1891.
- ELTONHEAD, W. B.
Nut Lock.—1885.
- ETCHELLS, HARRY, AND GRAVES, H. A.
Electric Arc Furnace.—1922.
- FLEMING, RICHARD; DEMPSTER, J. T. H.; GENERAL ELECTRIC COMPANY;
AND STEINMETZ, C. P.
Magnetite Lamp.—1908.
- GENERAL ELECTRIC COMPANY; DEMPSTER, J. T. H.; FLEMING, RICHARD;
AND STEINMETZ, C. P.
Magnetite Lamp.—1908.
- GETTY, JOHN K.
Bicycle Support.—1896.
- GILSON, EMERY G.
Calorizing Process.—1918.
- GLAZIER, JOHN T. AND PETER F.
Universal Nozzle.—1904.
- GOWDEY, J.
Compartment Drawer.—1902.
- GRAY, CHARLES B.
Sheet Metal Cutter.—1925.
- GREAVES, H. A., AND ETCHELLS, HARRY.
Electric Arc Furnace.—1922.
- GREENE, F. V. AND M. A.
Improvement in Windows.—1892.
- HAINES, R. B., JR.
Automatic Micrometer Gauge for Hot Metal.—1896.

CERTIFICATE OF MERIT AWARDS

HALLANAN, M.

Horseshoe and Pad.—1896.

HALLBERG, J. H.

Current System for Trunk Line Railways.—1906.

HANSON, FREEMAN.

Wood Turning Machine.—1891.

HARBOLSHEIMER, J.

Garbage Box.—1894.

HAVARD, OLIVER D.

Coal Meter.—1918.

HAYS, CHARLES AND JOSEPH.

CO₂ and Draft Recorder.—1920.

HEPBURN, J. S.; ST. JOHN, E. Q.; AND JONES, F. M.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

HILL, EDGAR.

Caliper Measuring Device.—1903.

HILL, MYRON F.

Roller Bearings.—1902.

INTERNATIONAL BURGLAR IMMUNITY CO.

Electric Protective Devices.—1905.

JONES, FRANK MORTON; HEPBURN, J. S.; AND ST. JOHN, E. Q.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the Sarraceniaceæ" (Paper).—1921.

KIDDE, WALTER, AND COMPANY.

Improved System of Detecting and Extinguishing Marine Fires.—1922.

KINNEY, R. D.

Internal Fired Water Tube Boiler.—1899.

LANCE, W. L.

Utilizing Oil Cloth Waste.—1888.

LAND, S.

Sash Cord Fastener.—1886.

LANDAU, DAVID, AND PARR, PERCY H.

"A New Theory of Plate Springs" (Paper).—1920.

MACDONALD, THOMAS H.

Apparatus for Recording Sound.—1900.

MCCHESNEY, R.

Improvements in T-Squares.—1893.

MCINTYRE COMPANY.

Electric Wire.—1893.

McLAUTHLIN, MARTIN B., AND TAYLOR, GEORGE.

Household Garbage Carbonizer.—1895.

CERTIFICATE OF MERIT AWARDS

MAXON, HARRY R.

Pre-mix Burner.—1923.

MENDENHALL, CHARLES E.

"Aeronautic Instruments" (Paper).—1922.

NABER, H. A.

Gas Voltameter.—1895.

NATIONAL NUTRIENT COMPANY.

Nutrium, a New Food Product.—1902.

NEUMEYER, H. F.

Spray Nozzle.—1895.

NOUY, P. LECOMTE DU.

Surface Tension Apparatus.—1923.

PARR, PERCY H., AND LANDAU, DAVID.

"A New Theory of Plate Springs" (Paper).—1920.

PARVIN, A. B.

Tele-photo Lens.—1895.

PHELPS, W. J.

Hylo-Incandescent Lamp.—1903.

PICH, FRIEDRICH.

Cast Iron Brazing.—1903.

PITNEY, ARTHUR H.

Postage Meter.—1922.

PROUTY, THEODORE C. and WILLIS O.

Chronometric Tachometer.—1925.

REAGAN, JAMES.

Improved Grates.—1900.

RIDGWAY, E. B.

Steam Hydraulic Elevator.—1914.

RINN, J. J.

Tent Fastening.—1904.

ROBINSON, CYRUS R.

Improved Fire Nozzle.—1905.

ROLIN, CHARLES W.

Adjustable and Interchangeable Grate.—1918.

ROWLAND, L. G.

Automatic Safety Device for Electric Circuits.—1897.

SADTLER, J. P. B.

Water Heater for Range Boilers.—1900.

SCHENCK, W. T. Y.

Improved Hose Reels.—1893.

SHEAF, PHILIP A.

Circle Drawing Attachment for Microscopes.—1916.

SIMPSON, W. L.

Steam Separator.—1894.

CERTIFICATE OF MEDAL AWARDS

STEIN, F. J.

An Improved and Simplified System of Pitman Phonography.—1904.

STEINMETZ, C. P.; DEMPSTER, J. T. H.; FLEMING, RICHARD; AND GENERAL
ELECTRIC COMPANY.

Magnetite Lamp.—1908.

ST. JOHN, E. Q.; HEPBURN, J. S.; AND JONES, F. M.

"Absorption of Nutrients and Allied Phenomena in the Pitchers of the
Sarraceniaceæ" (Paper).—1921.

SWEETLAND, ERNEST J.

Metallic Filter Cloth.—1918.

SWETT AND LEWIS COMPANY.

Static Machine for X-Ray Apparatus.—1899.

TAYLOR, GEORGE, AND MCLAUTHLIN, MARTIN B.

Household Garbage Carbonizer.—1895.

TAYLOR, WARREN H., AND BLOUNT, EUGENE I.

Door Check.—1902.

TUCKFIELD, C. B.

Stove Pipe Anchor.—1896.

VANIER, G. P.

Potash Bulb.—1914.

WARDEN, J. T.

Improved Drawing Board.—1893.

WEBER, GEORGE AND WILLIAM.

Speaking Attachment for Telephone.—1894.

WHINERY, SAMUEL BRENT.

Improved Method of Blueprinting.—1902.

WHITE, E. M.

Chimney for Incandescent Lamp.—1898.

WICKERSHAM, W.

Printers' Quoin.—1894.

WILKES, M.

Automatic Cut-off for Slide Valve Engines.—1889.

TERMS AND PRIVILEGES OF MEMBERSHIP

Members of the Institute shall consist of those engaged or interested in scientific pursuits or in the application of science in the mechanic and industrial arts. All persons interested in the purposes and activities of the Institute and who are willing to further them, may become members when proposed by members in good standing and elected by the Board of Managers. The membership of the Institute shall consist of the following classes of members; *viz.*: Honorary and Corresponding, Endowment, Life, Contributing, Resident, Non-resident, Student, and holders of Second Class Stock.

Honorary and Corresponding members shall be nominated by the Board of Managers and shall require for their election four-fifths of the votes of the members present at any stated meeting of the Institute at which their nomination may be acted upon. They shall not be entitled to vote nor to hold office. All other members shall be elected by the Board of Managers.

Endowment members shall consist of persons, firms, corporations or associations who shall make an endowment payment of five thousand dollars (\$5000) to the Institute, and who, upon acceptance thereof by the Board of Managers, shall thereafter have the privilege of nominating annually to the Board of Managers for election (subject to its discretion as to any particular nominee) as Resident members of the Institute for its then current year, without payment of dues, that number of persons, to be determined from time to time by the Board of Managers, whose annual dues, if they were paying annual Resident Membership dues, would approximately equal but not exceed the then current income from such endowment payments. Such Endowment Memberships shall be perpetual, and shall be transferable by the holders thereof by will or otherwise; provided, however, that the Board of Managers at any time may refund five thousand dollars (\$5000) to the then holders of any such membership, and annul and terminate that membership.

Contributing members shall consist of firms, corporations, associations or individuals who shall pay annually the sum of three hundred dollars (\$300). A contributing member shall have the right to nominate nineteen persons to the Board of Managers for election as Resident members for the year then current, subject to the discretion of the Board as to any particular nominee, and members thus elected shall pay no dues.

Resident Life members, whose membership shall not be transferable, are those members who shall pay the sum of three hundred dollars in any one year.

Non-resident Life members shall be those members who reside permanently at a distance of not less than twenty-five miles from Philadelphia and who shall pay the sum of one hundred dollars in any one year.

Resident members shall be residents of the City of Philadelphia who have been elected to membership in the Institute and who shall pay annual dues of fifteen dollars.

Non-resident members shall be those members who reside permanently at a distance of not less than twenty-five miles from Philadelphia and who shall pay annual dues of five dollars. They shall also pay an initiation fee of five dollars.

Student members shall be over sixteen and under twenty-two years of age. They shall pay annual dues of three dollars if they do not receive the JOURNAL of the Institute, and six dollars if they do receive the JOURNAL. The term of student members shall be limited by the age of twenty-two years, after which time they shall be eligible for transfer to the other types of membership upon the payment of the appropriate fee or dues.

Privileges: All members, of whatever class, are entitled to participate in the meetings of the Institute, in the use of the Library, to receive tickets for the lectures and to receive monthly one copy of the JOURNAL of the Institute, except that student members, and honorary and corresponding members, shall not have the right to vote, nor to hold office, and student members paying the three dollars annual dues shall not receive the JOURNAL of the Institute.

Resignations must be made in writing, and dues must be paid to the date of resignation.

Membership Badges.—Pin or button form, may be purchased from the Controller for One Dollar. All badges are numbered and the owner's name and number recorded.

For further information and membership application blanks address the SECRETARY OF THE INSTITUTE.

MEETINGS AND LECTURES

1926-1927

- Wednesday, October 20. Dr. W. D. Coolidge, Laboratories of the General Electric Company, Schenectady, New York, "The Production of High Voltage Cathode Rays Outside of the Generating Tube."
- Thursday, October 28. Meeting in celebration of "Management Week."
- Thursday, November 4. William F. Parish, Esq., Consulting Lubrication Engineer, New York City, "The Distillation of Petroleum for the Manufacture of the Lubricating Oils."
- Thursday, November 11. Howard T. Barnes, D.Sc., Professor of Physics, McGill University, "Thermit and Icebergs."
- Wednesday, November 17. Richard C. Tolman, Ph.D., Professor of Physical Chemistry and Mathematical Physics, California Institute of Technology, "Statistical Mechanics and Its Application to Physical-Chemical Problems."
- Thursday, December 2. Hugh Stott Taylor, D.Sc., Professor of Physical Chemistry, Princeton University, "Atomic Hydrogen and the Mechanism of Catalysis."
- Thursday, December 9. John Quincy Stewart, Ph.D., Professor of Astronomical Physics, Princeton University. "Hypotheses Regarding the Source of the Energy of Sun and Stars."
- Wednesday, December 15. Nevin E. Funk, Operating Engineer, Philadelphia Electric Company, Philadelphia, Pa., "Unusual Engineering Features of the Conowingo Dam and Power Plant."
- Thursday, January 13. Bergen Davis, Ph.D., Department of Physics, Columbia University, "Refraction of X-rays."
- Wednesday, January 19. Thomas Midgeley, Jr., Esq., Research Chemist, Dayton, Ohio, "Anti-Knock Motor Fuel."
- Thursday, January 27. George W. Morey, Ph.D., Geophysical Laboratory, Washington, D. C., "The Chemical Basis of Glass Technology."
- Thursday, February 3. L. B. Stiles, C.E., Construction Engineer, The Brooklyn Union Gas Company, "The Gowanus Canal Pipe Tunnel."
- Thursday, February 10. Wolfgang Klemperer, Esq., Akron, Ohio, "Soaring Flight."
- Wednesday, February 16. B. S. Hopkins, Ph.D., Department of Chemistry, University of Illinois, "Illinium."
- Thursday, February 24. H. B. Williams, Ph.D., College of Physicians and Surgeons, Columbia University, "Physical Instruments in Medical Service."
- Thursday, March 3. J. H. Dellinger, Ph.D., Senior Physicist, Bureau of Standards, Dept. of Commerce, Washington, D. C., "Directive Radio Transmission."
- Thursday, March 10. L. P. Alford, Editor, "Manufacturing Industries," New York City, "Safety and Production."

- Wednesday, March 16. C. H. Kunsman, Ph.D., Physicist, Fixed Nitrogen Research Laboratory, Bureau of Soils, Department of Agriculture, Washington, D. C., "The Thermionic Emission From Iron Alkali Mixtures Used as Catalysts in the Synthesis of Ammonia."
- Thursday, March 24. Robert H. Gault, Ph.D., Director, Vibro-Tactile Research Laboratory, Smith College, Northampton, Mass., "The Interpretation of Speech by Tactual and Visual Impression."
- Thursday, March 31. H. A. Lorentz, Ph.D., F.R.S., Professor of Physics, University of Leiden, Holland, "How Does an Atom Radiate Light?"
- Thursday, April 7. Edward Capps, Professor, Department of Classics, Princeton University, Princeton, N. J., Chairman of Managing Committee, American School of Classical Studies at Athens, "Excavation of Athens."
- Thursday, April 14. W. F. G. Swann, Sc.D., Director, Sloane Physics Laboratory, Yale University, New Haven, Conn., "What Is Left of the Atom."
- Wednesday, April 20. A. H. Markwart, Vice-President, Pacific Gas and Electric Company, San Francisco, California, "Power in California."
- Wednesday, May 18. Medal Day.

BARTOL RESEARCH FOUNDATION LECTURES

LECTURES BY R. WHIDDINGTON, M.A., D.Sc., F.E.S.

CAVENDISH PROFESSOR OF PHYSICS, DEAN OF THE FACULTY OF SCIENCE,
UNIVERSITY OF LEEDS, ENGLAND

Wednesday, October 13, 1926, at Four O'Clock, P.M.

THE LUMINOUS DISCHARGE THROUGH RARE GASES

LECTURES BY PROFESSOR R. C. TOLMAN

CALIFORNIA INSTITUTE OF TECHNOLOGY

November 17, at Eight-Fifteen O'Clock, P.M.

November 19, at Four O'Clock, P.M.

November 22, 1926, at Four O'Clock, P.M.

Wednesday, November 17—"THE METHODS OF STATISTICAL MECHANICS."

Comparison of the methods of ordinary and statistical mechanics. Comparison of the methods of statistical mechanics and thermodynamics. Ensemble and phase. Phase spaces. Distribution of ensemble in phase. Change in density of distribution with time (Liouville's theorem). Application to molecular systems. Ergodic hypothesis.

Friday, November 19—"SOME APPLICATIONS OF STATISTICAL MECHANICS TO SYSTEMS THAT ARE IN EQUILIBRIUM."

The Maxwell-Boltzmann distribution law. The Maxwell distribution law. Molecular collisions. The general equipartition law. Modifications introduced by quantum theory. Use of new form of Maxwell-Boltzmann distribution law. Application of statistical mechanics to concentrated systems. The prin-

ciple of dynamical reversibility. The principle of microscopic reversibility. Applications.

Monday, November 22—"SOME APPLICATIONS OF STATISTICAL MECHANICS TO SYSTEMS THAT ARE CHANGING TOWARDS THE CONDITION OF EQUILIBRIUM."

Boltzmann's H-Theorem. Extensions of the H-Theorem. Critique of the H-Theorem. Transport problems. Rate of chemical reaction. The existence of homogeneous non-catalyzed gas reactions. The rate of decomposition of nitrogen pentoxide. The temperature coefficient of rate of decomposition. The mechanism of activation. The transfer of energy to molecules.

CHRISTMAS WEEK LECTURES FOR YOUNG PEOPLE BY ROBERT W. WOOD

PROFESSOR OF PHYSICS, JOHNS HOPKINS UNIVERSITY, BALTIMORE

December 27, 28, 30 and 31, 1926, at Three O'Clock, P.M.

RECREATIONS WITH RADIATIONS

Monday, December 27, 1926

Analogies between sound and light. Waves originated by vibrators. Things that vibrate. Interference of sound-waves, two sounds producing silence. Resonance: a vibrator set in motion by waves. Detectors of sound and light other than the ear and eye. Singing flames and the rotating mirror. Beats between two flames of different pitch. Flames that hear notes inaudible to the ear, and flash in rhythm to the ticking of a watch.

Rijke's tube or the organ pipe that blows itself. High frequency sounds that destroy life. Water jets that are sensitive to sound. Why the drops scatter in a fountain. Scattering prevented by electricity. How rain drops form and why we have large drops in a thunderstorm. Can rain be induced artificially?

Rain makers and their devices.

Stroboscopic experiments with the fountain.

Electrical vibrators and Hertz waves. An electrical system that pulsates every three seconds.

TUESDAY, DECEMBER 28, 1926

Why we think that light consists of waves. White light and colored light. A lamp which causes moving white objects to appear in brilliant colors, though stationary objects appear white. Lamps that show all objects as uncolored. Why objects appear colored. Colors produced by absorption (body color) and by selective reflection (surface color).

The colors of the sky and sun-set colors.

The spectrum. Absorption and emission spectra. Metals that burn. How the spectroscope tells us what the sun and stars are made of.

THURSDAY, DECEMBER 30, 1926

Fluorescence substances which manufacture light of one color when illuminated by light of another color. Phosphorescence substances or storage batteries for light.

Interference of light. The colors of thin films. The opal and reflection by multiple films. Chlorate of potash iridescent crystals. Stationary light waves.

Lippman's color photographs.

Polarized light. Two perfectly transparent substances are opaque to light in a certain position.

Colors shown by crystals and minerals in polarized light.

FRIDAY, DECEMBER 31, 1926

Invisible light. Infra-red rays and how they are detected. Ultra-violet light. Uses of invisible light in peace and war. Secret signalling. Experiments with the ultra-violet lamp. Fluorescence and phosphorescence under ultra-violet light. Squeezing the stored light out of phosphorescent substances by infra-red rays.

•

MEMBERSHIP DIRECTORY

HONORARY MEMBERS

- Brigadier-General **JAMES ALLEN**, U. S. A. (Retired), Army and Navy Club, Washington, D. C.
 Colonel **GEORGE L. ANDERSON**, U. S. A. (Retired), Delafield, Wisconsin.
 Prof. **SVANTE AUGUST ARRHENIUS**, Nobel Institute, Stockholm, Sweden.
 Prof. **NIELS BOHR**, Institute of Theoretical Physics, University of Copenhagen, Copenhagen, Denmark.
 Brigadier-General **JOHN J. CARTY**, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
 Mr. **THOMAS A. EDISON**, Orange, New Jersey.
 Prof. **CHARLES FABRY**, Professor of Physics, University of Paris, 1 Rue Victor-Cousin, Paris (5e), France.
 General **G. FERRIE**, Inspecteur des Services de la Telegraphie Militaire et des Transmissions, 51 bis, Boulevard Latour-Maubourg, Paris, France.
 Prof. **GEORGE FORBES**, No. 11 Little College Street, Westminster, S. W., London, England.
 Prof. **HENDRIK A. LORENTZ**, Zeyweg 76, Haarlem, Holland.
 Senator **GUGLIELMO MARCONI**, Royal Italian Senate, Rome, Italy.
 Dr. **A. A. MICHELSON**, Professor of Physics, University of Chicago, Chicago, Illinois.
 Dr. **RALPH MODJESKI**, 818 Widener Building, Philadelphia, Pennsylvania.
 Rear-Admiral **JOSEPH B. MURDOCK**, U. S. N. (Retired), Danbury, New Hampshire.
 The Hon. Sir **CHARLES A. PARSONS**, 6 Windsor Terrace, Newcastle-on-Tyne, England.
 General **JOHN J. PERSHING**, War Department, Washington, D. C.
 Mr. **RALPH W. POPE**, 16 Castle Hill Avenue, Great Barrington, Massachusetts.
 Dr. **SAMUEL REA**, Retired President, Pennsylvania Railroad Company, Room 215, Broad Street Station, Philadelphia, Pennsylvania.
 Prof. **THEODORE WILLIAM RICHARDS**, Wolcott Gibbs Memorial Laboratory, Harvard University, Cambridge, Massachusetts.
 Sir **ERNEST RUTHERFORD**, Cavendish Professor of Experimental Physics, The University of Cambridge, Cambridge, England.
 Rear-Admiral **WILLIAM S. SIMS**, U. S. N., General Board, Naval War College, Newport, Rhode Island.
 Mr. **FRANK J. SPRAGUE**, Consulting Engineer, President, Sprague Safety Control and Signal Corporation, 421 Canal Street, New York City, New York.
 Hon. **WILLIAM C. SPROUL**, 117 South Sixteenth Street, Philadelphia, Pennsylvania.
 Major-General **GEORGE OWEN SQUIER**, War Department, Washington, D. C.
 Rear-Admiral **DAVID WATSON TAYLOR**, U. S. N., 1813 19th Street, N. W., Washington, D. C.
 Dr. **ELIHU THOMSON**, 22 Monument Avenue, Swampscott, Massachusetts.
 Sir **JOSEPH J. THOMSON**, Trinity College, Cambridge, England.
 Prof. **WILLIAM CAWTHORNE UNWIN**, Palace Gate Mansions, Kensington, London, England.
 Dr. **EDWARD WESTON**, President, Weston Electrical Instrument Company, Newark, New Jersey.
 Dr. **H. W. WILEY**, Room 1120, Woodward Building, Washington, D. C.
 Dr. **PIETER ZEEMAN**, Stadhouderskade 158, Amsterdam, Holland.

CORRESPONDING MEMBERS

- Prof. **A. S. EVE**, McGill University, Montreal, Canada.
 Prof. **JOHN SEALY TOWNSEND**, New College, Oxford, England.

IN MEMORIAM

- Mr. **ISAAC B. THORN**.

MEMBERS

- ABBOTT, ROBERT R.**, Metallurgical Engineer, The Peerless Motor Car Company, Cleveland, Ohio.
ABRAMS, PETER, 918 Chestnut Street, Philadelphia, Pennsylvania.
ACHESON, Dr. EDWARD G., Manufacturer, Acheson Corporation, 689 Fifth Avenue, New York City, New York.
ADAMS, BENJAMIN FRANKLIN, Vice-President, Charles F. Adams, 218-224 North Water Street, and for mail, 948 Buchanan Avenue, Lancaster, Pennsylvania.
ADAMS, Dr. EDWIN P., Professor of Physics, Princeton University, and for mail, 12 Nassau Street, Princeton, New Jersey.
ADAMS, MERRITT H., Woodlawn Terrace, Beechhurst, Long Island.
ADAMS, WILLIAM, Jr., Electric Furnace Department, The Ajax Metal Company, Frankford Avenue and Richmond Street, Philadelphia, Pennsylvania.
ADDICKS, WALTER R., President, Consolidated Gas Company of New York, 130 East 15th Street, New York City, New York.
ADSIT, CHARLES G., Engineer, 555 Electric and Gas Building, Atlanta, Georgia.
AIKEN, FRANK, 401 Abbottsford Road, Philadelphia, Pennsylvania.

- AKIMOFF, NICHOLAS W.**, Mechanical and Hydraulic Engineer, 1013 Harrison Building, Philadelphia, Pennsylvania.
- ALBRECHT, A. C.**, Vice-President, North Bros. Manufacturing Company, Lehigh Avenue and American Street, Philadelphia, Pennsylvania.
- ALBRECHT, HERMAN C.**, Manager Purchasing, Stores and Transportation, Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- ALLAN, ANDREW, Jr.**, Manufacturer of Bearing Metals, Harrison, New Jersey.
- ALLEMAN, GELLERT**, Professor of Chemistry, Swarthmore College, and for mail, 8 Whittier Place, Swarthmore, Pennsylvania.
- ALLEN, ARTHUR HARTMAN, Jr.**, Inventor, Victor Talking Machine Company, Camden, New Jersey, and for mail, 4019 Baring Street, Philadelphia, Pennsylvania.
- ALLEN, HENRY B.**, Metallurgical Engineer, 8112 St. Martin's Lane, Chestnut Hill, Philadelphia, Pennsylvania.
- ALLEN, JAMES**, Brigadier-General, U. S. A., Army and Navy Club, Washington, D. C.
- ALLEN, WILLIAM N.**, Retired Chemical Manufacturer, 557 Church Lane, Germantown, Philadelphia, Pennsylvania.
- ALSBERG, Dr. CARL L.**, Stanford University, California.
- AMES, Dr. JOSEPH S.**, Director, Physical Laboratory, The Johns Hopkins University, Baltimore, Maryland.
- ANDERSEN, OLAF**, Geologist, Norges Geologiske Undersølske, Kronprinsensgt 2, Oslo, Norway.
- ANDERSEN, ROBERT**, Teacher, The Episcopal Academy, Overbrook, and for mail, 35 West LaCrosse Avenue, Lansdowne, Pennsylvania.
- ANDERSON, CYRUS**, Patent Lawyer, (Attorney-at-Law), 519 Land Title Building, Philadelphia, and for mail, 440 Haverford Road, Narberth, Pennsylvania.
- ANDERSON, FRANK**, Mining Engineer, 1172 Harvard Avenue, Salt Lake City, Utah.
- ANDERSON, Colonel GEORGE L.**, U. S. A. (Retired), Delafield, Wisconsin.
- ANDERSON, Dr. ROBERT J.**, 2448 Beekman Street, Cincinnati, Ohio.
- ANDREAU, ROLAND L.**, Consulting Chemical Engineer and Research Chemist, Laurel Springs, New Jersey.
- ANDREWS, W. S.**, Consulting Electrical Engineer, General Electric Company, Schenectady, New York.
- ANDRUS, LUCIUS B.**, Guaranty Building, Indianapolis, Indiana.
- ARCHBALD, SARA T.**, Professor of Physics and Chemistry, Rosemont College, Rosemont, Pennsylvania.
- ARMSTRONG, WILLIAM R.**, Clerk, Powers-Weightman-Rosengarten Company, Philadelphia, Pennsylvania.
- ARNOLD, Dr. H. D.**, Director of Research, Engineering Department, Western Electric Company, New York City, New York.
- ARNSTEIN, HENRY**, Consulting Engineer, 191 East Roosevelt Boulevard, Philadelphia, Pennsylvania.
- ARMY, Dr. H. V.**, Teacher and Chemist, 115 West 68th Street, New York City, New York.
- ARRHENIUS, SVANTE AUGUST**, Physicist, Nobel Institute, Stockholm, Sweden.
- ASHBROOK, Dr. DONALD S.**, Chemist, 2404 Willard Street, Wilmington, Delaware.
- ASHHURST, JOHN**, Librarian, The Free Library of Philadelphia, Logan Square, Philadelphia, Pennsylvania.
- ASHWORTH, HAROLD**, 4925 Pulaski Avenue, Philadelphia, Pennsylvania.
- ATKINSON, ROBERT**, Hampton Institute, Virginia.
- ATLEE, JOSHUA W.**, Naval Architect, William Cramp and Son's Ship and Engine Building Company, and for mail, Riverton, New Jersey.
- ATLEE, WALTER**, Civil Engineer, 6 West Read Street, Baltimore, Maryland.
- ATTERBURY, W. W.**, Brigadier-General, President, Pennsylvania Railroad Company, Broad Street Station, Philadelphia, Pennsylvania.
- ATWATER, RICHARD M., Jr.**, Consulting Mining Engineer, Scarsdale, New York.
- AUSTIN, Dr. LOUIS W.**, Bureau of Standards, Washington, D. C.
- AUSTIN, W. L.**, Vice-Chairman of the Board, The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- AYRES, EUGENE E., Jr.**, Chemical Engineer, Sharples Specialty Company, 23rd and Westmoreland Streets, Philadelphia, Pennsylvania.
- BABCOCK, A. F.**, Engineering Assistant, Traffic Department, Eastern Area, Bell Telephone Company, 1631 Arch Street, Philadelphia, Pennsylvania.
- BACON, Dr. RAYMOND FOSS**, Chemical Engineer, Chemists Building, 50 East 41st Street, New York City, New York.
- BADENHAUSEN, CARL W.**, Mechanical Engineer, Short Hills, New Jersey.
- BAEKELAND, Dr. L. H.**, Research Chemist, Snug Rock, Harmony Park, Yonkers-on-Hudson, New York.
- BAILEY, RAYMOND**, Electrical Engineer, Philadelphia Electric Company, and for mail, Merion Cricket Club, Haverford, Pennsylvania.
- BAKER, GEORGE FALES**, Physician, 403 Lafayette Building, Philadelphia, Pennsylvania.
- BALCH, ALFRED C.**, Publisher, 227 South 6th Street, Philadelphia, Pennsylvania.
- BALDWIN, FREDERIC E.** (Retired), 2200 Walnut Street, Philadelphia, Pennsylvania.
- BALLANTINE, STUART**, 441 Locust Street, Germantown, Philadelphia, and for mail, White Haven, Pennsylvania.
- BALLARD, R. H.**, Vice-President and Assistant General Manager, Southern California Edison Company, Edison Building, Los Angeles, California.
- BALLENTINE, WILLIAM I.**, Vice-President, Advance Rumely Company, La Porte, Indiana.
- BALLS, WILLIAM H.**, South Philadelphia High School, Broad and Jackson Streets, Philadelphia, Pennsylvania.
- BANCROFT, JOHN**, Manufacturer, Wilmington, Delaware.

- BANCROFT, JOSEPH**, Vice-President and Treasurer, Joseph Bancroft and Sons, Wilmington, Delaware.
- BANNISTER, J. C.**, University Club, 76 East Monroe Street, Chicago, Illinois.
- BANTA, CLIFFORD**, Chief Chemist, Barrett Company, Margaret and Bermuda Streets, Philadelphia, Pennsylvania.
- BARBA, MILTON N.**, Sales Engineer, Leeds and Northrup Company, 4901 Stenton Avenue, Philadelphia, Pennsylvania, and for mail, 511 Gravers Lane, Chestnut Hill, Philadelphia, Pennsylvania.
- BARDO, CLINTON L.**, Vice-President, American Brown Boveri Electric Corporation, P. O. Box 358, Camden, New Jersey.
- BARNES, JAMES**, Professor of Physics, Bryn Mawr College, Bryn Mawr, Pennsylvania.
- BARNES, JOHN HAMPTON**, Attorney-at-Law, Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- BARNETT, EDWIN S.**, Wheat Starch Manufacturer, 7011 Cresheim Road, Mount Airy, Philadelphia, Pennsylvania.
- BARNHART, G. EDWARD**, Aeronautical Engineer, 1547 East Walnut Avenue, Pasadena, California.
- BARR, Major JOHN H.**, Mechanical Engineer, The Barr-Morse Corporation, Ithaca, New York.
- BARRINGER, DANIEL MOREAU**, Geologist and Mining Engineer, 1242 Real Estate Trust Building, Philadelphia, Pennsylvania.
- BARTH, CARL G.**, Consulting Engineer, 424 Whitney Avenue, New Haven, Connecticut.
- BARTOW, EDWARD**, Chemistry Department, State University of Iowa, Iowa City, Iowa.
- BASSETT, WILLIAM H.**, Technical Superintendent, American Brass Company, Waterbury, Connecticut, and for mail, Cheshire, Connecticut.
- BATES, C. W.**, Electrical Engineer, Philadelphia Electric Company, and for mail, 403 North Narberth Avenue, Narberth, Pennsylvania.
- BATES, E. F.**, 248 Sheldon Street, Philadelphia, Pennsylvania.
- BATES, ONWARD**, Civil Engineer, 934 John's Road, Augusta, Georgia.
- BAUER, PAUL SHERMAN**, Student, Cruft Laboratory, Harvard University, Cambridge, Massachusetts.
- BAZZONI, Dr. CHARLES BLIZARD**, Professor of Experimental Physics, Randal Morgan Laboratories, University of Pennsylvania, Philadelphia, Pennsylvania.
- BEACH, CHARLES S.**, Designer and Machinist, 753 Main Street, Bennington, Vermont.
- BEALE, HORACE A., Jr.**, President, Parkesburg Iron Company, Parkesburg, Pennsylvania.
- BEALE, LEONARD T.**, Secretary, John T. Lewis and Brother Company, 705 Lafayette Building, Philadelphia, Pennsylvania.
- BEATH, E. R.**, Lapidist and Jeweler, 129 South 12th Street, Philadelphia, Pennsylvania.
- BECK, M. A.**, Vice-President and Chief Engineer, Milwaukee Electric Crane and Manufacturing Company, 294 Greenbush Street, Milwaukee, Wisconsin.
- BECKER, IRWIN A.**, Pharmacist, in care of Michael Reese Hospital, 2839 Ellis Avenue, Chicago, Illinois.
- BEHR, LEO**, Research Engineer, Leeds and Northrup Company, 4901 Stenton Avenue, Philadelphia, Pennsylvania.
- BELFIELD, T. BROOM**, Manufacturer, 1905 Spring Garden Street, Philadelphia, Pennsylvania.
- BELL, JOSEPH PERCY**, Mechanical Engineer, 30th and Race Streets, Philadelphia, Pennsylvania, and for mail, 230 North Monroe Street, Media, Pennsylvania.
- BELL, J. SNOWDEN**, Attorney-at-Law, Box 629, City Hall Station, New York City, New York.
- BEMENT, A. C.**, Bell Telephone Company, 1835 Arch Street, Philadelphia, Pennsylvania.
- BEMENT, WILLIAM P.** (Retired), 743 Real Estate Trust Building, Philadelphia, Pennsylvania.
- BENNETT, C. E.**, Electrical Engineer, Georgia Railway and Power Company, Atlanta, Georgia.
- BENNETT, JOSEPH S., Jr.**, 6310 Woodbine Avenue, Overbrook, Pennsylvania.
- BENZON, GEORGE H., Jr.**, Vice-President, Wm. Sellers & Company, Mechanical Engineer, 252 Mather Road, Jenkintown, Pennsylvania.
- BERG, ERNST J.**, Professor of Electrical Engineering, Union College, Schenectady, New York.
- BERG, HOLGER V.**, Chemical Engineer, Newport, Delaware.
- BERG, P. ESKIL**, Electrical Engineer, General Electric Company, Schenectady, New York, and for mail, 14 Lowell Road, Schenectady, New York.
- BERLINER, EMILE**, Engineer, 1458 Columbia Road, Washington, D. C.
- BERLINER, HERBERT S.**, Engineer, Compo Company, Limited, 131 18th Avenue, Lachine, Canada.
- BERRSFORD, A. W.**, care of Nizer Corporation, 7424 Mackie Street, Detroit, Michigan.
- BIDDLE, CHARLES M., Jr.**, Riverton, New Jersey.
- BIDDLE, ELIZABETH C.**, 400 South 15th Street, Philadelphia, Pennsylvania.
- BIDDLE, JAMES C., Jr.**, Abbey of Gethsemani, Trappist Post Office, Kentucky.
- BIDDLE, JAMES G.**, Importer of Scientific Apparatus, Wallingford, Pennsylvania.
- BIDDLE, ROBERT**, President, Biddle-Gaumer Company, 3846-3856 Lancaster Avenue, Philadelphia, Pennsylvania.
- BIERBAUM, CHRISTOPHER H.**, Consulting Engineer, 113 Parkside Avenue, Buffalo, New York.
- BIGELOW, S. LAWRENCE**, Professor of General and Physical Chemistry, University of Michigan, Ann Arbor, Michigan.
- BILGRAM, HUGO**, Machinist, 1235 Spring Garden Street, Philadelphia, Pennsylvania.
- BILLINGS, A. W. K.**, Civil, Mechanical and Electrical Engineer, in care of Brazilian Hydro Electric Company, Limited, Caixa do Correio 2444, Rio de Janeiro, Brazil.
- BILLOW, CLAYTON O.**, Consulting Engineer, 1431 Jarvis Avenue, Rogers Park, Chicago, Illinois.
- BILYEU, THOMAS**, Mechanical Engineer, 697 East Broadway Street, Portland, Oregon.

- BINDER, RICHARD L.**, President, K. and B. Company, Special Electrical Supplies, 931 North 8th Street, Philadelphia, Pennsylvania.
- BINSWANGER, JACK G.**, Technical Director and Chief Chemist, Thomson Wood Finishing Company, 829 North Third Street, Philadelphia, Pennsylvania.
- BIRCH, GEORGE W., Jr.**, Chemist, 7427 Bond Avenue, Upper Darby, Pennsylvania.
- BIRKINBINE, CARL PETER**, Engineer, Room 800, Commercial Trust Building, Philadelphia, Pennsylvania.
- BLACKBURN, ARTHUR**, Grain Merchant, 315 Chamber of Commerce, and for mail, 405 Hollen Road (Cedarcroft), Baltimore, Maryland.
- BLACKBURN, CAROLINE D.**, Chemist, 7028 Paschall Avenue, Philadelphia, Pennsylvania.
- BLAIR, A. A.**, Analytical Chemist, 406 Locust Street, Philadelphia, Pennsylvania.
- BLAKE, A. E.**, Sales Engineer, United Gas Contracting Company, 1401 Arch Street, Philadelphia, Pennsylvania.
- BLATZ, FREDERICK J.**, Leather Manufacturer, P. O. Box 967, Wilmington, Delaware.
- BLOEDE, VICTOR GUSTAVE**, Manufacturing Chemist, Carroll Post Office, Baltimore, Maryland.
- BLUM, ARTHUR N.**, Mechanical Engineer, Delmar-Morris Apartments, Germantown, Philadelphia, Pennsylvania.
- BODINE, GEORGE I., Jr.**, Banker, 816 Packard Building, Philadelphia, and for mail, 118 Pelham Road, Mt. Airy, Philadelphia, Pennsylvania.
- BODINE, SAMUEL T.**, President, United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- BOEKKEL J.**, Manufacturer of Metal Goods, 518 Vine Street, Philadelphia, Pennsylvania.
- BOERICKE, FELIX A.**, (Retired), Bryn Athyn, Pennsylvania.
- BOERICKE, GIDEON**, Civil Engineer, Wynnewood, Pennsylvania.
- BOERICKE, JOHN J.**, Merion, Pennsylvania.
- BOHR, Professor NIELS**, Institute of Theoretical Physics, University of Copenhagen, Copenhagen, Denmark.
- BOLEY, CONRAD HENRY**, Research Chemist, 3729 North Randolph Street, Philadelphia, Pennsylvania.
- BOLTON, Dr. ELMER K.**, Chemist, Jackson Laboratory, Box 525, Wilmington, Delaware.
- BONDON, LOUIS B.**, Mechanical Engineer, Christiansa Machine Company, Christiansa, Pennsylvania.
- BONINE, CHARLES E.**, Consulting and Designing Engineer, Franklin Trust Building, 20 South 15th Street, Philadelphia, Pennsylvania.
- BONN, N. E.**, Electrical Engineer, Leeds and Northrup Company, 4901 Stenton Avenue, Philadelphia, Pennsylvania.
- BOOZ, H. C.**, Chief Engineer, Berwind-White Coal Mining Company, 1100 Commercial Trust Company, Philadelphia, Pennsylvania.
- BORIE, BEAUVAU, Jr.**, Investment Broker, 1517 Locust Street, Philadelphia, Pennsylvania.
- BORTON, GEORGE W.**, President and General Manager, Pennsylvania Crusher Company, 1324 Stephen Girard Building, Philadelphia, Pennsylvania.
- BOSTWICK, J. VAUGHAN**, Haverford, Pennsylvania.
- BOURNE, GEORGE L.**, Vice-President, Locomotive Superheater Company, 17 East 42nd Street, New York City, New York.
- BOWEN, SAMUEL B.**, Manufacturer, 4th Street and Sedgley Avenue, Philadelphia, Pennsylvania.
- BOWER, WILLIAM HENRY**, Manufacturing Chemist, 29th Street and Gray's Ferry Road, Philadelphia, Pennsylvania.
- BOYER, MURRAY C.**, Solicitor of Patents, 829 Stephen Girard Building, 21 South 12th Street, Philadelphia, Pennsylvania.
- BRADBURY, Dr. ROBERT H.**, Science Teacher, Southern High School, 2100 Shunk Street, Philadelphia, Pennsylvania.
- BRADDOCK-ROGERS, K.**, 125 West Park Avenue, Haddonfield, New Jersey.
- BRADLEY, A. J.**, Manufacturer, 101 Beekman Street, New York City, New York.
- BRADY, EDWARD J.**, Engineering Research, 3101 Passyunk Avenue, Philadelphia, Pennsylvania.
- BREED, GEORGE**, Consulting Engineer, University Club, 1510 Walnut Street, Philadelphia, Pennsylvania.
- BREWER, Dr. J. EDWARD**, Vice-President and Chief Chemist, Southeast Corner 18th and Cherry Streets, Philadelphia, Pennsylvania.
- BREWER, ROBERT W. A.**, Consulting Engineer, East Township Line, Jenkintown, Pennsylvania.
- BRIESEN, FRITZ V.**, Attorney-at-Law, 50 Church Street, New York City, New York.
- BRIGHT, JOHN IRWIN**, Architect, Ardmore, Pennsylvania.
- BRIGHTCLIFFE, NORMAN J.**, Engineering Department, Leeds and Northrup Company, 4901 Stenton Avenue, Philadelphia, Pennsylvania, and for mail, 2460 North Cleveland Avenue, Philadelphia, Pennsylvania.
- BRINLEY, CHARLES E.**, President, American Pulley Company, 4200 Wissahickon Avenue, Philadelphia, Pennsylvania.
- BRINTON, CLEMENT STARR**, Food Inspection Chemist, 134 South Second Street, Philadelphia, Pennsylvania.
- BRINTON, RUSSELL L.**, 3700 Kensington Avenue, Philadelphia, Pennsylvania.
- BROCK, JOHN W.**, Retired Attorney, 1607 Walnut Street, Philadelphia, Pennsylvania.
- BROMLEY, JOSEPH H.**, Manufacturer, Chelton and Wissahickon Avenues, Philadelphia, Pennsylvania.
- BROOKE, F. M.**, Banker, Brooke Stokes and Company, Northeast Corner 15th and Locust Streets, Philadelphia, Pennsylvania.
- BROWN, FRANCIS SHUNK**, Lawyer, 1005 Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.

- BROWN, GABRIEL SCOTT**, President, Alpha Portland Cement Company, Harrison Building, Philadelphia, Pennsylvania, and for mail, 720 Meixell Street, Easton, Pennsylvania.
- BROWN, RICHARD P.**, President, Brown Instrument Company, Wayne and Windrim Avenues, Philadelphia, Pennsylvania.
- BROWN, WILLIAM LIKENS**, District Manager, Industrial Works of Bay City, Michigan, and for mail, 1505 Packard Building, Philadelphia, Pennsylvania.
- BROWNSTEIN, BENJAMIN**, Mechanical Engineer, Elwood City, Pennsylvania.
- BRUCE, WILLIAM D.**, 152 Rhodes Avenue, Haddonfield, New Jersey.
- BRUNKER, ROBERT J.**, Banker, 1000 Walnut Street, Philadelphia, Pennsylvania.
- BRUSH, CHARLES F.**, Electrical Engineer, 3725 Euclid Avenue, Cleveland, Ohio.
- BRYANT, Dr. ALICE GERTRUDE**, Physician, 502 Beacon Street, Boston, Massachusetts.
- BUCK, H. W.**, Consulting Engineer, 49 Wall Street, New York City, New York.
- BUCKLEY, Dr. OLIVER E.**, Electrical Engineer, 463 West Street, New York City, New York.
- BUDD, A. Van WYCK**, Berwyn, Prince George County, Maryland.
- BUDD, EDWARD G.**, Machinist, 157 Pelham Road, Germantown, Philadelphia, Pennsylvania.
- BUDD, EDWARD G., Jr.**, 127 Pelham Road, Germantown, Philadelphia, Pennsylvania.
- BULLOCK, WILLIAM E.**, Mechanical Engineer, 29 West 39th Street, New York City, New York.
- BUNNELL, STERLING H.**, Vice-President and Manager, Ash Reclaiming Machinery Corporation, 347 Madison Avenue, New York City, New York.
- BUREAU, E. W.**, Bronze Founder, Southeast Corner 23rd and Westmoreland Streets, Philadelphia, Pennsylvania.
- BURHORN, EDWIN**, Engineer and Contractor, 938 Hudson Street, Hoboken, New Jersey.
- BURK, CHARLES A. D.**, Physical Chemist and Inventor, 21 South Oakland Avenue, Ventnor, New Jersey.
- BURK, EDWIN H.**, Merchant, 105 South Derby Avenue, Ventnor, New Jersey.
- BURLINGAME, LUTHER D.**, Industrial Superintendent, Brown and Sharpe Manufacturing Company, Providence, Rhode Island.
- BURROUGHS, JOSEPH H.**, Attorney-at-Law, 300 Bullitt Building, Philadelphia, Pennsylvania.
- BURTON, MAURICE CARTER**, Retired Lumber Manufacturer, The Wood-Norton Apartment C-1, Germantown, Philadelphia, Pennsylvania.
- BUSSER, FRANK S.**, Attorney-at-Law, 904 Land Title Building, Philadelphia, Pennsylvania.
- BUTTS, DONALD C. A.**, Research Physicist and Chemist, 1730 Spruce Street, Philadelphia, Pennsylvania, and for mail, 4402 Walnut Street, Philadelphia, Pennsylvania.
- BYERS, ISAAC W.** (Retired), Iron River, Michigan.
- BYRD, JOHN**, Metal Worker, address unknown.
- CABOT, GEORGE E.**, 169 Marlborough Street, Boston, Massachusetts.
- CAIRD, JAMES M.**, Chemist and Bacteriologist, Cannon Building, Broadway and Second Street, Troy, New York.
- CALKINS, G. H.**, Manager, General Electric Company, Tenth Floor, Electric Building, Buffalo, New York.
- CALVERT, HAROLD**, Consulting Engineer, Calvert and Barnes, 2114 Sansom Street, Philadelphia, Pennsylvania.
- CANBY, HENRY M.**, Wholesale Lumberer, 600 Equitable Building, Wilmington, Delaware.
- CANBY, WILLIAM W.**, Fruit Grower, Grants Pass, Oregon.
- CAPLES, MARTIN J.**, Vice-President, Seaboard Airline Railway Company, and for mail, 701 Stockley Gardens, Norfolk, Virginia.
- CAPP, JOHN A.**, Mechanical Engineer, 1309 Union Street, Schenectady, New York.
- CAPP, S. BUNKER**, Capitalist, P. O. Box 2054, Philadelphia, Pennsylvania.
- CAPPS, W. L.**, Rear-Admiral, U. S. N., Chief Constructor, Bureau of Construction and Repair, Navy Department, Washington, D. C.
- CARD, PAUL QUINNELL**, Instructor in Chemistry, 145 North 10th Street, Philadelphia, Pennsylvania, and for mail, 45 Delaware Street, Woodbury, New Jersey.
- CARTER, EDWARD C.**, Consulting Engineer, 412 Greenwood Boulevard, Evanston, Illinois.
- CARTY, Brigadier-General JOHN J.**, Vice-President and Chief Engineer, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
- CARY, C. REED**, Vice-President, Leeds and Northrup Company, 4901 Stenton Avenue, Philadelphia, Pennsylvania.
- CASACOF, CHRISTO**, Consulting Engineer, 138 Rue de la Tombe-Issoire, Paris, France.
- CASEY, Major K. K. V.**, Director of Sales, E. I. duPont de Nemours Company, Room 5060 duPont Building, Wilmington, Delaware.
- CASPARI, Dr. CHARLES E.**, Professor of Chemistry, 2108 Locust Street, St. Louis, Missouri.
- CASSELMAN, WILLIAM S.**, Attorney-at-Law, Secretary, West Jersey Title and Guarantee Company, and for mail, 317 Penn Street, Camden, New Jersey.
- CATON, JOHN J.**, Professor of Automotive Engineering, University of Detroit, Detroit, Michigan.
- CHAFFEE, E. LEON**, Assistant Professor of Physics, Cruft Laboratory, Cambridge, Massachusetts.
- CHAMBERS, Dr. ARTHUR DOUGLAS**, Chemical Engineer, E. I. du Pont de Nemours and Company, and for mail, 509 Lore Avenue, Wilmington, Delaware.
- CHAMBERS, FRANCIS T.**, Attorney-at-Law, 605-608 New Stock Exchange Building, 1411 Walnut Street, Philadelphia, Pennsylvania.
- CHAMBERS, J. HOWARD**, Chambers Brothers Company, Founders and Machinists, and for mail, 52nd and Media Streets, Philadelphia, Pennsylvania.
- CHANCE, Dr. EDWIN M.**, Consulting Chemist and Engineer, care of Day and Zimmermann, 1600 Walnut Street, Philadelphia, Pennsylvania.
- CHANCE, Dr. HENRY M.**, Mining Engineer and Geologist, 839 Drexel Building, Philadelphia, Pennsylvania.
- CHANDLER, T. P.**, Architect, Ithan Farm, Radnor, Pennsylvania.

- CHARLTON, RICHARD C.**, 5017 Griscom Street, Frankford, Philadelphia, Pennsylvania.
- CHESTERMAN, FRANCIS J.**, Chief Engineer, The Bell Telephone Company, 416 Seventh Avenue, Pittsburgh, Pennsylvania.
- CHRISMAN, CHAS. S.**, Mechanical Engineer, The United Gas Improvement Company, 435 West Miner Street, West Chester, Pennsylvania.
- CHRISTIANSON, A.**, Chief Engineer, Standard Steel Car Company, and for mail, P. O. Box 877, Butler, Pennsylvania.
- CHURCH, ARTHUR L.**, Secretary of The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- CLAGHORN, CLARENCE R.**, Mining Engineer, 715 Continental Building, Baltimore, Maryland.
- CLAMER, G. H.**, Metallurgist and Chemist, First Vice-President and Secretary, The Ajax Metal Company, Frankford Avenue and Richmond Street, Philadelphia, Pennsylvania.
- CLARK, BEAUVAIS**, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, Miss DARTHELA**, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, Lieutenant-Colonel EDWARD B.**, Publisher, Potomac Hotel, Washington, D. C.
- CLARK, EDWARD L.**, Engineer, American Motor Body Company, 18th Street and Lehigh Avenue, Philadelphia, Pennsylvania.
- CLARK, E. W.**, Banker, 321 Chestnut Street, Philadelphia, Pennsylvania.
- CLARK, FRANK SHAW**, Mechanical Engineer, Stone and Webster Engineering Corporation, 49 Federal Street, Boston, Massachusetts.
- CLARK, Dr. HERBERT A.**, Physicist, 93 Ames Street, Rochester, New York.
- CLARK, JOSEPH S.**, Attorney-at-Law, Highland Avenue, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, THEOBALD F.**, 490 East Abington Avenue, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, WALTON**, Consulting Engineer, The United Gas Improvement Company, and for mail, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK Mrs. WALTON**, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLARK, WALTON, Jr.**, Attorney-at-Law, Stenton and Abington Avenues, Chestnut Hill, Philadelphia, Pennsylvania.
- CLOTHIER, MORRIS LEWIS**, Merchant, 801 Market Street, Philadelphia, Pennsylvania.
- CLOUD, JOHN W.**, Chairman, The Westinghouse Brake and Saxby Signal Company, Limited, 82 York Road, King's Cross, London, N. 1, England.
- CLYMER, EVAN MORGAN**, Chief Clerk, Inspector of Hull Material for U. S. Navy, and for mail, 142 East Fishers Avenue, Olney, Philadelphia, Pennsylvania.
- COATES, JESSE**, Consulting Engineer and Metallurgist, 40 Ocean Avenue, Lynn, Massachusetts.
- COCHRAN, C. B.**, Chemist, State Dairy and Food Commission, and for mail, 514 South High Street, West Chester, Pennsylvania.
- COCKERILL, H. W.**, Technical Clerk, 19 Rata Road, Hataitai, Wellington, New Zealand.
- COLLINGWOOD, J. REED**, Buyer, Fels and Company, and for mail, 510 South 41st Street, Philadelphia, Pennsylvania.
- COLLINS, CHARLES RUSSELL**, Consulting Engineer, 805 Lowman Building, Seattle, Washington.
- COLLINS, HENRY H.**, Manufacturer, 226 Columbia Avenue, Philadelphia, Pennsylvania.
- COLLOM, SAMUEL H.**, President, Pennsylvania Flexible Metallic Tubing Company, 505 Abbott Building, Philadelphia, Pennsylvania.
- COLVIN, CHARLES H.**, Mechanical Engineer, 8 Willow Place, Brooklyn, New York.
- COLVIN, FRED H.**, Editor, *American Machinist*, Tenth Avenue at 36th Street, New York City, New York, and for mail, 46 Lenox Avenue, East Orange, New Jersey.
- COLVIN, HENRY FRED, and**, 754 Lexington Avenue, Brooklyn, New York.
- COLWELL, ROBERT C.**, Professor of Physics, Geneva College, Beaver Falls, Pennsylvania, and for mail, 332 Demain Avenue, Morgantown, West Virginia.
- COMEY, Dr. ARTHUR M.**, Chemist, 380 Mt. Auburn Street, Cambridge, Massachusetts.
- CONAWAY, JOHN F.**, Secretary and Treasurer, National Umbrella Frame Company, 30th and Thompson Streets, Philadelphia, Pennsylvania.
- CONDICT, G. H.**, Consulting Mechanical and Electrical Engineer, 922 Central Avenue, Plainfield, New Jersey.
- CONN, CHARLES F.**, President, Giant Portland Cement Company, Pennsylvania Building, Philadelphia, Pennsylvania.
- CONVERSE, WILLIAM A.**, Chemical Engineer, Dearborn Chemical Company, McCormick Building, Chicago, Illinois.
- COOKE, MORRIS LLEWELLYN**, Consulting Engineer in Management, Acting Director, The Utilities Bureau, 1009 Finance Building, Philadelphia, and for mail, St. George's Road, Mt. Airy Post Office, Philadelphia, Pennsylvania.
- COOKSON, RAYMOND B.**, Electrical and Mechanical Engineer, 5243 Warrington Avenue, Philadelphia, Pennsylvania.
- COOLEY, MORTIMER E.**, Dean, Colleges of Engineering and Architecture, Engineering Building, University of Michigan, Ann Arbor, Michigan.
- COOPER, HENRY**, Manufacturer of Olive Oil, 403 East Valerio Street, Santa Barbara, California.
- COPE, THOMAS D.**, Assistant Professor of Physics, Randal Morgan Laboratory of Physics, University of Pennsylvania, Philadelphia, Pennsylvania.
- COPPAGE, BENJAMIN DENVER**, Production Engineer, Levgor Structural Company, New York City, and for mail, 2402 Willard Street, Wilmington, Delaware.

- COPPAGE, GEORGE L.**, Production Manager, The Pusey and Jones Company, Wilmington, Delaware.
- CORNELIUS, CLARENCE E.**, Salesman, 162 West Coulter Street, Germantown, Philadelphia, Pennsylvania.
- CORNELIUS, JOHN C.**, Architect, 211 West Cheltenham Avenue, Germantown, Philadelphia, Pennsylvania.
- CORNELIUS, JUSTICE C.**, Civil Engineer, 821 Lehigh Street, Easton, Pennsylvania.
- COTTELL, JAMES W.**, First Lieutenant, Ordnance Reserve Corps, United States Army, Technical Editor, *Motor Transport*—Chilton Class Journal Company, 56th and Chestnut Streets, Philadelphia, Pennsylvania, and for mail, 409 Bellevue Avenue, Hammoncton, New Jersey.
- COWAN, WILLIAM ARTHUR**, Assistant Chief Chemist, National Lead Company, 105 York Street, Brooklyn, New York.
- COWLES, ALFRED H.**, President, Electric Smelting and Aluminum Company, Sewaren, New Jersey.
- COX, J. D.**, President, Cleveland Twist Drill Company, Cleveland, Ohio.
- COX, JOHN L.**, Mechanical Engineer, 12 Summit Street, Chestnut Hill, Philadelphia, Pennsylvania.
- COX, WALTER**, President, Pennsylvania Wire Glass Company, Pennsylvania Building, Philadelphia, Pennsylvania.
- COYLE, GEORGE L., S. J.**, Professor of Organic Chemistry, Georgetown University, Washington, D. C.
- CRAGO, WILLIAM H.**, Civil Engineer, in care of Fajardo Sugar Company, Fajardo, Porto Rico.
- CRAIG, ROBERT**, Consulting Engineer, 42 Broadway, New York City, New York.
- CRAMP, FRANCIS L.**, Assistant to President, Wm. Cramp and Sons Ship and Engine Building Company, Philadelphia, Pennsylvania.
- CRAMPTON, GEORGE S.**, Physician, 1819 Walnut Street, Philadelphia, Pennsylvania.
- CRAWFORD, D. F.**, General Manager, Pennsylvania Lines West of Pittsburgh, 5243 Ellsworth Avenue, Pittsburgh, Pennsylvania.
- CREIGHTON, H. JERMAIN**, Associate Professor of Chemistry, Swarthmore College, Swarthmore, Pennsylvania.
- CRENSHAW, Dr. JAMES L.**, Professor of Physical Chemistry, Bryn Mawr, Pennsylvania.
- CRITCHON, ANDREW B.**, U. S. Bank Building, Johnstown, Pennsylvania.
- CROASDALE, JOHN P.**, Attorney-at-Law, 1011 Chestnut Street, Philadelphia, Pennsylvania.
- CROOK, ALFRED**, Phoenix Roll Works, 1506 Widener Building, Philadelphia, Pennsylvania.
- CROWELL, WALTER S.**, Chemical Engineer, Oak Lane, Philadelphia, Pennsylvania.
- CULLEN, GEORGE S.**, Insurance, 4504 Springfield Avenue, Philadelphia, Pennsylvania.
- CUMMINGS, J. H.**, President, John B. Stetson Company, Philadelphia, Pennsylvania.
- CUNNINGHAM, J. L.**, Superintendent of Motive Power, Pennsylvania Railroad Company, Pittsburgh, Pennsylvania.
- CURTIS, CYRUS H. K.**, Curtis Publishing Building, Philadelphia, Pennsylvania.
- CURTISS, ELLIOTT**, President and Treasurer, The United States Metallic Packing Company, 429 North 13th Street, Philadelphia, Pennsylvania.
- CURWEN, SAMUEL M.**, President, J. G. Brill Company, and for mail, Haverford, Pennsylvania.
- CUSHMAN, Dr. ALLERTON S.**, 898 Park Avenue, New York City, New York.
- DACOSTA, J. CHALMERS, 3rd**, Mechanical Engineer, Indemnity Insurance Company of America, 232 Walnut Street, Philadelphia, Pennsylvania.
- DANNENBAUM, HERMAN N.**, Manufacturer, Vice-President, National Ammonia Company, Frankford, Philadelphia, Pennsylvania.
- DARROW, KARL K.**, Physicist, 463 West Street, New York City, and for mail, 230 West 105th Street, New York City, New York.
- DASHIELL, BENJ. J.**, Consulting Engineer, Dunkirk P. O., Calvert County, Maryland.
- DASHIELL, P. T.**, Assistant Engineer of Works, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- DAVIDHEISER, LEE**, Professor of Chemistry, Millersville Normal School, Millersville, Pennsylvania.
- DAVIDS, R. W.**, Consulting Electrical Engineer, Merion Station, Pennsylvania.
- DAVIDSON, GEORGE M.**, Chemist and Engineer of Tests, C. & N. W. R. R. Company, Chicago, Illinois.
- DAVIDSON, WARD F.**, Electrical Engineer, 380 Pearl Street, Brooklyn, New York.
- DAVIS, CARLETON E.**, Civil Engineer, 1612 Market Street, Philadelphia, Pennsylvania.
- DAVIS, CHARLES HENRY**, President and Trustee, Bass River, Cape Cod, Massachusetts.
- DAWES, JAMES H.**, General Contractor, 1310 Arch Street, Philadelphia, Pennsylvania.
- DAWSON, WILFRED THOMAS**, Professor of Physiology, Medical Department, University of Texas, Galveston, Texas.
- DAY, Dr. ARTHUR L.**, Director, Geophysical Laboratory, Carnegie Institution, Washington, D. C.
- DAY, CHARLES**, President, Day and Zimmermann, Engineers, 1600 Walnut Street, Philadelphia, Pennsylvania.
- DAY, ROLAND B.**, Engineer, Room 842, 25 Broadway, New York City, New York.
- De GRAAFF, ANTONIUS**, Chemical Engineer, Philips' Glowlampworks, Limited, Eindhoven, Holland.
- DeKRAFFT, WILLIAM**, Treasurer, Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- DELANO, FREDERIC A.**, 407 Hibbs Building, Washington, D. C.
- DELBRIDGE, Dr. T. G.**, Atlantic Refining Company, 260 South Broad Street, Philadelphia, Pennsylvania.
- DELLENBAUGH, FREDERICK S., Jr.**, Electrical Engineer, Massachusetts Institute of Technology, and for mail, 91 Spooner Road, Chestnut Hill, Massachusetts.

- DEMPSEY, W. L.**, Patent Attorney and Consulting Engineer, 400 Granite Building, St. Louis, Missouri.
- DENIG, FRED.**, Combustion Engineer, Box 365, Fort Wayne, Indiana.
- DERCUM, Dr. FRANCIS X.**, Physician, 1719 Walnut Street, Philadelphia, Pennsylvania.
- DESHONG, HOWARD T.**, Superintendent, Philadelphia Electric Company, and for mail, 9 Lansdowne Avenue, Lansdowne, Pennsylvania.
- DETWILER, J. G.**, Chemist, The Texas Company, Whitehall Building, 17 Battery Place, New York City, New York.
- DICKERSON, EDWARD N.**, Attorney-at-Law, 41 Park Row, New York City, New York.
- DIDIER, PAUL**, Principal Assistant Engineer, Baltimore and Ohio Railroad Company, Maloney Building, 339 Second Street, Pittsburgh, Pennsylvania.
- DIEFFENBACH, ALBERT C.**, Commander, Naval Officer, (Retired), 146 West Cheltenham Avenue, Germantown, Philadelphia, Pennsylvania.
- DIKE, PAUL HARRISON**, Research Physicist, Leeds and Northrup Company, 4901 Stenton Avenue, Philadelphia, Pennsylvania, and for mail, 252 High Street, Germantown, Philadelphia, Pennsylvania.
- DILKS, WALTER H.**, 521 Commercial Trust Building, Philadelphia, Pennsylvania.
- DILLENBECK, CLARK**, Civil Engineer, 518 East Mermaid Lane, Chestnut Hill, Philadelphia, Pennsylvania.
- D'INVILLIERS, EDWARD VINCENT**, Geologist and Mining Engineer, 121 North Broad Street, Philadelphia, Pennsylvania.
- DISSTON, WILLIAM D.**, Manufacturer, in care of Henry Disston and Sons, Tacony, Philadelphia, Pennsylvania.
- DOANE, SAMUEL E.**, Chief Engineer, National Lamp Works of the General Electric Company, Nela Park, Cleveland, Ohio.
- DOBSON, WILLIAM ALEXANDER**, Naval Architect, Cramp Shipyard, Philadelphia, Pennsylvania, and for mail, 5918 Wayne Avenue, Philadelphia, Pennsylvania.
- DODGE, KERN**, Consulting Engineer, Morris Building, Philadelphia, Pennsylvania.
- DOHERTY, HENRY L.**, President, Cities Service Company, 60 Wall Street, New York City, New York.
- DOLAN, THOMAS J.**, Chestnutwold Farm, Villa Noya, Pennsylvania.
- DONALD, WILLIAM**, Chemist and Assayer, Bloomingdale, New Jersey.
- DONOHUE, JOHN P.**, Coal Operator, Coulter Building, Greensburg, Pennsylvania.
- DORR, JOHN V. N.**, Metallurgical and Chemical Engineer, President, The Dorr Company, The Architects Building, 247 Park Avenue, New York City, New York.
- DORSEY, FARNUM F.**, Patent Attorney, 373 Lyell Avenue, Rochester, New York.
- DOUGHERTY, THOMAS HARVEY, Jr.**, 104 South Fifth Street, Philadelphia, Pennsylvania, and for mail, 230 South 19th Street, Philadelphia, Pennsylvania.
- DOUGLASS, WILLIAM ALEXANDER**, Research Chemist, Jackson Laboratory, E. I. duPont de Nemours and Company, Wilmington, Delaware, and for mail, 28½ Ziegler Tract, Penns Grove, New Jersey.
- DOUREDOURE, BERNARD L.**, Student, 103 Walnut Street, Philadelphia, Pennsylvania.
- DOUTHIRT, WALSTEIN F.**, 1752 Equitable Building, New York City, New York.
- DOW, HERBERT H.**, General Manager, The Dow Chemical Company, Midland, Michigan.
- DOWNS, WILLIAM FINDLAY.**, Engineer, Vice-President, Day and Zimmermann, 1600 Walnut Street, Philadelphia, Pennsylvania.
- DOYLE, WILLIAM J.**, Contractor and Builder, 1519 Sansom Street, Philadelphia, Pennsylvania.
- DRAKE, LEWIS MARVIN**, Experimental Scientist, 509 North First Street, Daytona Beach, Florida.
- DREXEL, JOHN R.**, 112 Drexel Building, Philadelphia, Pennsylvania.
- DUBILIER, WILLIAM**, President, Dubilier Condenser and Radio Corporation, 4377 Bronx Boulevard at 238th Street, New York City, New York.
- DUBOSQUE, F. L.**, Superintendent of Floating Equipment, Pennsylvania Station, New York City, New York.
- DUNCAN, J. S.**, Inventor, 901 West Van Buren Street, Chicago, Illinois.
- DUNCAN, THOMAS**, President, Duncan Electric Manufacturing Company, Lafayette, Indiana.
- DUNDORE, CHARLES R.**, 8205 Seminole Avenue, Philadelphia, Pennsylvania.
- DUNLAP, GLENDEEN J.**, Student, 3224 North Seventh Street, Philadelphia, Pennsylvania.
- DUNN, CHARLES**, Manufacturer of Insecticide, Lock Haven, Pennsylvania.
- DUNN, GANO**, President, J. G. White Engineering Corporation, and for mail, 20 Washington Square, New York City, New York.
- DUNNINGTON, F. P.**, Professor of Chemistry, University of Virginia, Virginia.
- Du PONT, IRENEE**, Vice-President, E. I. du Pont de Nemours and Company, Wilmington, Delaware.
- Du PONT, PIERRE S.**, President, E. I. du Pont de Nemours and Company, Wilmington, Delaware.
- DURBAN, THOMAS E.**, General Manager, Erie City Iron Works, Erie, Pennsylvania.
- D'UTASSY, GEO.**, Publisher, Cedarhurst, Long Island, New York.
- DYER, FRANK LEWIS**, Mechanical Expert, 217 Broadway, New York City, New York.
- EATON, GEORGE W., Jr.**, Electrician, 1915 South 12th Street, Philadelphia, Pennsylvania.
- EAVENSON, HOWARD N.**, Engineer, 4311 Bayard Street, Pittsburgh, Pennsylvania.
- EBERLE, E. G.**, Editor of the Journal of the American Pharmaceutical Association, 10 West Chase Street, Baltimore, Maryland.
- ECKER, HOWARD**, Chemist, R. F. Johnston Paint Company, Cincinnati, Ohio, and for mail, 1510 Dana Avenue, Cincinnati, Ohio.
- ECKERT, SAMUEL B.**, Oil Refiner, Finance Building, 1428 South Penn Square, Philadelphia, Pennsylvania.
- ECKHARDT, E. A.**, Marland Oil Company, Ponca City, Oklahoma.

- EDGAR, C. L.**, President and General Manager, Edison Electric Illuminating Company, 70 State Street, Boston, Massachusetts.
- EDISON, THOMAS A.**, Inventor, Orange, New Jersey.
- EGLESON, J. ERNEST A.**, Chemical Engineer, General Chemical Company, Marcus Hook, Pennsylvania, and for mail, 71 South Munn Avenue, East Orange, New Jersey.
- EGLIN, ARCHIBALD, C., Jr.**, Apprentice in Transportation Department, Pennsylvania Railroad System, Altoona, Pennsylvania, and for mail, 55 Merbrook Lane, Merion, Pennsylvania.
- EGLIN, WM. C. L.**, Vice-President and Chief Engineer, Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- EGLOFF, Dr. GUSTAV**, Petroleum Technologist, The Universal Oil Product Company, Strass Building, Chicago, Illinois.
- EHRENFELD, Dr. FREDERICK**, College Hall, University of Pennsylvania, Philadelphia, Pennsylvania.
- EHRET, CORNELIUS D.**, Patent Lawyer, 6911 Clearview Street, Mount Airy, Philadelphia, Pennsylvania.
- ELDRED, Dr. BYRON E.**, 41 East 42nd Street, New York City, New York.
- ELKINS, GEORGE W.**, Vice-President of Companies, Land Title Building, Philadelphia, Pennsylvania.
- ELKINTON, HOWARD W.**, Assistant Manager, Foreign Department, Philadelphia Quartz Company, 121 South Third Street, Philadelphia, Pennsylvania.
- ELKINTON, THOMAS W.**, Philadelphia Quartz Company, 121 South Third Street, Philadelphia, Pennsylvania.
- ELLIOT, EDWIN**, Foundry Superintendent, 403 West Price Street, Germantown, Philadelphia, Pennsylvania.
- ELLIS, CARLETON**, Research Chemist and Chemical Engineer, 92 Greenwood Avenue, Montclair, New Jersey.
- ELLIS, WILLIAM GODEY**, Engineer, 1811 Washington Street, Wilmington, Delaware.
- ELMENDORF, ARMIN**, Consulting Engineer, 645 North Michigan Avenue, Chicago, Illinois.
- ELMORE, GUY HARTWELL**, Consulting Engineer, 1505 Race Street, Philadelphia, Pennsylvania, and for mail, 201 Elm Avenue, Swarthmore, Pennsylvania.
- ELSEY, HOWARD MCKEE**, Research Chemist, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania, and for mail, 378 College Avenue, Oakmont, Pennsylvania.
- ELVERSON, JAMES, Jr.**, Publisher, The Philadelphia Inquirer, Philadelphia, Pennsylvania.
- EMERICH, L. E.**, Salesman, Leeds and Northrup Company, 4901 Stenton Avenue, Philadelphia, Pennsylvania, and for mail, 6214 Morton Street, Philadelphia, Pennsylvania.
- EMERICK, J. M.**, Office Manager, 1501 Commonwealth Building, Philadelphia, Pennsylvania.
- EMERSON, GEORGE H.**, Chief of Motive Power and Equipment, Baltimore and Ohio Railroad, Baltimore, Maryland.
- EMERSON, HARRINGTON**, Efficiency Engineer, Room 1522, Hudson Terminal Building, 30 Church Street, New York City, New York.
- ENGELHARD, CHARLES**, Importer, Hudson Terminal Building, 30 Church Street, New York City, New York.
- EPPELSHEIMER, DANIEL, Jr.**, Chief Engineer, 419 Broadway, Middletown, Ohio.
- EPPLEY, MARION**, Commander, Scientist, Eppley Scientific Laboratory, Newport, Rhode Island.
- ERHART, WILLIAM H.**, Manufacturing Chemist, 81 Maiden Lane, New York City, New York.
- ERICKSON, ROBERT B.**, Metallurgist, 1726 Roslyn Street, Philadelphia, Pennsylvania.
- ERNE, ALFRED**, Clerk, William H. Horstmann Company, and for mail, 20 East Athens Avenue, Ardmore, Pennsylvania.
- ETTINGER, R. L.**, Consulting Mechanical Engineer, Southern Railway, 1300 Pennsylvania Avenue, Washington, D. C.
- EVANS, HENRY CARTER**, Student, Riverton, New Jersey.
- EVANS, OWEN BROOKE**, Mechanical Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- EVANS, POWELL**, 2035 Washington Avenue, Philadelphia, Pennsylvania.
- EVANS, WAYNE S.**, Manufacturer of Metal Goods, 4623 Paul Street, Frankford, Philadelphia, Pennsylvania.
- EVE, A. S.**, Professor of Physics, McGill University, Montreal, Canada.
- FABRY, CHARLES**, Professor of Physics, University of Paris, 1 Rue Victor-Cousin, Paris (5e) France.
- FAIRCHILD, S. E., Jr.**, Civil and Mining Engineer, Land Title Building, Philadelphia, Pennsylvania.
- FAIRCHILD, SHERMAN M.**, Engineer, Fairchild Aerial Camera Corporation, 136 West 52nd Street, New York City, New York, and for mail, 898 Park Avenue, New York City, New York.
- FALKENAU, ARTHUR**, Industrial Engineer, 4 East 88th Street, New York City, New York.
- FAUGHT, Dr. L. ASHLEY**, Professor of Operative Dentistry, Philadelphia Dental College, 18th and Buttonwood Streets, Philadelphia, Pennsylvania.
- FEARING, FREDERICK C.**, Consulting Engineer, 2112 Delancey Place, Philadelphia, Pennsylvania.
- FEARON, CHARLES**, Banker, 333 Chestnut Street, Philadelphia, Pennsylvania.
- FEBIGER, C. C.**, 3421 Powelton Avenue, Philadelphia, Pennsylvania.
- FELLOWS, E. R.**, President and General Manager, The Fellows Gear Shaper Company, Springfield, Vermont.
- FELS, MAURICE**, 4323 Spruce Street, Philadelphia, Pennsylvania.

- FELS, SAMUEL S.**, Soap Manufacturer, 39th and Walnut Streets, Philadelphia, Pennsylvania.
- FELTON, EDGAR CONWAY**, President, Pennsylvania Steel Company, and for mail, Haverford, Pennsylvania.
- FELTON, SAMUEL M.**, President, Chicago Great Western Railway, 1121 Peoples Gas Building, Chicago, Illinois.
- FERGUSON, JOHN**, Electrical Engineer, 506 Guaranty Building, Indianapolis, Indiana.
- FERGUSON, LOUIS A.**, Vice-President and Electrical Engineer, Commonwealth Edison Company, Box 767, 72 West Adams Street, Chicago, Illinois.
- FERGUSON, WALTER B.**, 426 School Lane, Germantown, Philadelphia, Pennsylvania.
- FERNALD, ROBERT HEYWOOD**, Whitney Professor of Dynamical Engineering, Mechanical Engineering Department, University of Pennsylvania, Philadelphia, Pennsylvania.
- FERREE, Dr. C. E.**, Teacher, Bryn Mawr College, Bryn Mawr, Pennsylvania.
- FERRIE, General G.**, Inspecteur des Services de la Telegraphie Militaire et des Transmissions, 51 bis, Boulevard LaTour-Maubourg, Paris, France.
- FIESER, LOUIS F.**, Chemist, Bryn Mawr College, Bryn Mawr, Pennsylvania.
- FINCH, WILLIAM G. H.**, 3572 De Kalb Avenue, Bronx, New York City, New York.
- FINKBNER, E. W.**, Representative, E. F. Houghton Company, and for mail, 6007 Oxford Street, Philadelphia, Pennsylvania.
- FINLEY, W. H.**, President C. and N. W. Railway Company, and for mail, 412 North Washington Street, Wheaton, Illinois.
- FIORIO, ANDREW**, 5333 Germantown Avenue, Philadelphia, Pennsylvania.
- FISHER, THOMAS**, General Manager, Berwind-White Coal Mining Company, 1100 Commercial Trust Building, Philadelphia, Pennsylvania.
- FITTS, JAMES LOGAN**, Mechanical Engineer, in care of Warren Webster and Company, 17th and Federal Streets, Camden, New Jersey.
- FITZ, E. M.**, Electrical Engineer, 58 East Dunlap Street, Worthington, Ohio.
- FITZGERALD, FRANCIS A. J.**, Consulting Engineer and President, The Fitzgerald Laboratories, Niagara Falls, New York.
- FITZMAURICE, WILLIAM J., Jr.**, Civil Engineer, 747 Marlyn Road, Philadelphia, Pennsylvania.
- FLANAGAN, CHARLES L.**, Insurance, Riverton, New Jersey.
- FLANAGAN, LOUIS A.**, Riverton, New Jersey.
- FLANDERS, RALPH E.**, Manager, Jones and Lamson Machine Company, and for mail, 41 Pleasant Street, Springfield, Vermont.
- FLEMING, ANDREW**, Merchant, 81/8 Bentinck Street, Calcutta, India.
- FLEMING, FRANCIS P.**, Attorney-at-Law, 301 Heard Building, Jacksonville, Florida.
- FLETCHER, W. E.**, Technical Director, Atlas Powder Company, Wilmington, Delaware, and for mail, 4609 Osage Avenue, Philadelphia, Pennsylvania.
- FOLEY, JOHN GRAHAM**, Estimator, Brooklyn Edison Company, Brooklyn, New York, and for mail, 917 77th Street, Brooklyn, New York.
- FORBES GEORGE**, Professor of Electrical Engineering, No. 11 Little College Street, Westminster, S. W., London, England.
- FORD, BRUCE**, Vice-President, Electric Storage Battery Company, 19th Street and Allegheny Avenue, Philadelphia, Pennsylvania.
- FORD, TERENCE J.**, Assistant Inspector of Ordnance, U. S. Navy, and for mail, 847 East Fourth Street, Bethlehem, Pennsylvania.
- FORREST, CHARLES N.**, 175 Elm Avenue, Rahway, New Jersey.
- FORSTAL, C. F.**, Assistant Supervisor, Pottstown, Pennsylvania.
- FORSTAL, WALTON**, Gas Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- FORTIER, MATTHEW L.**, Professor of Philosophy, College of the Holy Cross, Worcester, Massachusetts.
- FRANCIS, ISAAC H.**, Consulting Mechanical and Electrical Engineer, Otis Building, Philadelphia, Pennsylvania.
- FRANCIS, JOHN K.**, Draftsman, The Baldwin Locomotive Works, and for mail, 536 North 19th Street, Philadelphia, Pennsylvania.
- FRANK, EDWIN**, Mechanical Engineer, 1015 Shepard Avenue, Milwaukee, Wisconsin.
- FRANKLIN, BENJAMIN**, Civil and Consulting Engineer, 906-907 Crozer Building, Philadelphia, Pennsylvania.
- FRAZIER, GEORGE H.**, Banker, P. O. Box 1630, Philadelphia, Pennsylvania.
- FRAZIER, W. W., Jr.**, Sugar Refiner, Lock Box 1630, Philadelphia, Pennsylvania.
- FREEMAN, HAROLD A.** (Retired), St. Davids, Pennsylvania.
- FREEMAN, W. W.**, President, The Union Gas and Electric Company, 4th and Plum Streets, Cincinnati, Ohio.
- FRERICHS, Dr. F. W.**, Vice-President, Herf and Frerichs Chemical Company, 4557 West Pine Boulevard, St. Louis, Missouri.
- FRETZ, E. S.**, Manufacturer, The Light Manufacturing and Foundry Company, Pottstown, Pennsylvania.
- FRIES, HAROLD H.**, Manufacturing Chemist, 92 Reade Street, New York City, New York.
- FRY, ANN W.**, 6433 Cherokee Street, Germantown, Philadelphia, Pennsylvania.
- FRYER, GEORGE G.**, Mechanical Engineer, 203 Onondaga Avenue, Syracuse, New York.
- FUGUET, HOWARD**, 560 Bullitt Building, 121-141 South 4th Street, Philadelphia, Pennsylvania.
- FULLER, GEORGE W.**, Consulting Engineer, 170 Broadway, New York City, New York.
- FULWEILER, W. H.**, Engineer, United Gas Improvement Company, 319 Arch Street, Philadelphia, Pennsylvania.
- FUNK, N. E.**, Electrical Engineer, 930 Wynnwood Road, Philadelphia, Pennsylvania.
- FURNESS, GEORGE W.**, Millville, New Jersey.
- FURNESS, HORACE HOWARD, Jr.**, Writer, 2034 Delancey Place, Philadelphia, Pennsylvania.

- FURNESS, RADCLIFFE**, Engineer of Research, Midvale Steel Company, 4300 Wissahickon Avenue, Philadelphia, Pennsylvania.
- GAGE, Dr. HENRY PHELPS**, Physicist, Chief, Optical Division, Corning Glass Works, and for mail, 214 Chemung Street, Corning, New York.
- GALLOWAY, C. D.**, Mechanical Engineer, Electric Storage Battery Company, and for mail, 8409 Anderson Street, Chestnut Hill, Philadelphia, Pennsylvania.
- GARMAN, FRANK R.**, Electrical Engineer, 416 Seventh Avenue, Pittsburgh, Pennsylvania.
- GARRELS, W. L.**, Consulting Engineer (Kirkwood Route 13), Mason and Manchester Roads, St. Louis County, Missouri.
- GARRISON, F. LYNWOOD**, Mining Engineer, 1019 Clinton Street, Philadelphia, Pennsylvania.
- GARTLEY, WILLIAM H.**, Gas Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- GAZZAM, JOSEPH M.**, Retired Lawyer, 2201 Chestnut Street, Philadelphia, Pennsylvania.
- GERHARD, Dr. ARTHUR HOWELL**, Manufacturer and Instructor in Medicine, 1615 North Delaware Avenue, Philadelphia, Pennsylvania.
- GESELL, W. H.**, Chemical Engineer and Manager, Lehn and Fink, Incorporated, Bloomfield, New Jersey, and for mail, 235 Christopher Street, Montclair, New Jersey.
- GEST, WILLIAM P.**, Chairman, Fidelity-Philadelphia Trust Company, 327 Chestnut Street, Philadelphia, Pennsylvania.
- GETMAN, Dr. FREDERICK H.**, Chemist, Hillside Laboratory, Stamford, Connecticut.
- GFRORER, A. H.**, Engineer, 507 East Pearl Street, Cincinnati, Ohio.
- GHERARDI, BANCROFT**, Engineer of Plant, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
- GIBBS, A. E.**, Chemist, Pennsylvania Salt Manufacturing Company, Widener Building, Philadelphia, Pennsylvania.
- GIBBS, E. L.**, Inspector, Interstate Commerce Commission, and for mail, 2004 Herschell Street, Jacksonville, Florida.
- GIBBS, WEBB L.**, Lubricating Engineer, 7734 South Shore Drive, Chicago, Illinois.
- GIBBS, WINFIELD S.**, American Engineering Company, 2001 East Cambria Street, Philadelphia, Pennsylvania.
- GIBSON, HENRY CLAY**, Treasurer, Bank of North America and Trust Company, Philadelphia, Pennsylvania, and for mail, Jenkintown, Pennsylvania.
- GIBSON, J. J.**, Vice-President, Westinghouse Commercial Investment Company, 150 Broadway, New York City, New York.
- GIBSON, KENNETH**, Machinist, Cramps Shipyard, Beach and Palmer Streets, and for mail, 2843 North 11th Street, Philadelphia, Pennsylvania.
- GIESLER, JEAN V.**, Mechanical Engineer, The Fulton Company, Knoxville, Tennessee, and for mail, Box 834, Knoxville, Tennessee.
- GILCHRIST, JOHN F.**, Vice-President, Commonwealth Edison Company, Edison Building, Chicago, Illinois.
- GILL, JOHN D.**, Chemical Engineer, Atlantic Refining Company, 260 South Broad Street, Philadelphia, Pennsylvania.
- GILMAN, FRANKLIN W.**, 4700 Wissahickon Avenue, Germantown, Philadelphia, Pennsylvania.
- GILPIN, FRANCIS H.**, Gas Engineer, 22 Edgemont Avenue, Summit, New Jersey.
- GITTLESON, FRANK**, Violinist, Mt. Washington, Baltimore, Maryland.
- GLOVER, ROLFE E., Jr.**, Chemist, 2435 West 18th Street, Wilmington, Delaware.
- GODFREY, H. LINWOOD**, Patent Solicitor, Electrical Engineer, 32 South Broad Street, Philadelphia, Pennsylvania.
- GOETZENBERGER, RALPH LEON**, Electrical Engineer, 8016 Flourtown Road, Chestnut Hill, Philadelphia, Pennsylvania.
- GOLDBAUM, JACOB S.**, Research Chemist, 4234 Spruce Street, Philadelphia, Pennsylvania.
- GOLDSCHMIDT, V.**, Professor, Heidelberg University, and for mail, Gaisberg Strasse 9, Heidelberg, Germany.
- GOLDSMITH, EDWIN M.**, Manufacturer, Friedberger-Aaron Manufacturing Company, Logan Station, Philadelphia, Pennsylvania.
- GOMBERG, MOSES**, Professor of Chemistry, 712 Onandago Street, Ann Arbor, Michigan.
- GOODSPEED, ARTHUR W.**, Professor of Physics, University of Pennsylvania, Philadelphia, Pennsylvania.
- GOODWIN, HAROLD, Jr.**, Electrical Engineer, 118 Walnut Street, Jenkintown, Pennsylvania.
- GORDON, HUGH S.**, Mining Engineer, 10 Nevill Court, London, England.
- GOTTSCHALK, OTTO**, Civil Engineer, Casilla Correo 1723, Buenos Aires, Argentine.
- GRAFTON, E. H.**, Chief Chemist, Quaker City Rubber Company, Wissinoming, Philadelphia, Pennsylvania.
- GRAHAM, WALTER F.**, Chief Metallurgist, American Nickel Corporation, Clearfield, Pennsylvania.
- GRANBERY, J. H.**, Civil Engineer, American Can Company, 234 West 21st Street, New York City, New York.
- GRAVELL, J. H.**, President, American Chemical Paint Company, Ambler, Pennsylvania.
- GREENE, ARTHUR M., Jr.**, Professor of Mechanical Engineering, Princeton University, Princeton, New Jersey.
- GREENE, JOSEPH F.**, Chemical Engineer, Kimble Glass Company, Vineland, New Jersey.
- GREENWOOD, RICHARD**, Acting Superintendent, 4520 Worth Street, Frankford, Philadelphia, Pennsylvania.
- GREENWOOD, TALMA TEMPLE**, Research Engineer and Patent Solicitor, 40 Court Street, Boston, Massachusetts.
- GREER, WILLARD N.**, Research Chemist, Leeds and Northrup Company, 4901 Stenton Avenue, Philadelphia, Pennsylvania.

- GREVEMEYER, GEORGE A.**, 122 South 13th Street, Philadelphia, Pennsylvania.
- GRIBBEL, JOHN**, Gas Meter Manufacturer, 1513 Race Street, Philadelphia, Pennsylvania.
- GRIBBEL, W. GRIFFIN**, Gas Meter Manufacturer, 1513 Race Street, Philadelphia, Pennsylvania.
- GRIEST, Major THOMAS H.**, Civil Engineer, The Bell Telephone Company, and for mail, 623 Westview Street, Mt. Airy, Philadelphia, Pennsylvania.
- GRIFFIN, FRANK H.**, Chief Chemist, Viscose Company, Marcus Hook, Pennsylvania.
- GRIFFITH, W. O.**, "The Clearing," Saunderstown, Rhode Island.
- GRISCOM, LESLIE**, Mechanical and Electrical Engineer, John Lang Paper Company, and for mail, 5332 North Camac Street, Philadelphia, Pennsylvania.
- GRISSINGER, ELWOOD**, Consulting Electrical and Mechanical Engineer, 293 Lexington Avenue, Buffalo, New York.
- GRISWOLD, ROBERT G.**, Director of Research, Henry L. Doherty and Company, 60 Wall Street, New York City, New York.
- GRONDAHL, L. O.**, Director of Research, Union Switch and Signal Company, Swissvale, Pennsylvania.
- GROSSCUP, HENRY ARTHUR**, Salesman, Southeast Corner 5th and Chestnut Streets, Philadelphia, Pennsylvania.
- GUBELMAN, FREDERICK J.**, President, The Regina Company, and for mail, Woodland Avenue, Englewood, New Jersey.
- GUCKER, F. T.**, Civil Engineer and Contractor, 1450 Real Estate Trust Building, Philadelphia, Pennsylvania.
- GUDEMAN, Dr. EDWARD**, Consulting Scientific Expert, 903 Postal Telegraph Building, Chicago, Illinois.
- GUNN, DONALD**, Engineer, 435 Sixth Avenue, Pittsburgh, Pennsylvania.
- GUTHRIE, BAYARD, R.F.D. No. 2**, Ocean Springs, Mississippi.
- HACHIKIAN, CHARLES**, Chemical Engineer, 5427 Summer Street, Philadelphia, Pennsylvania.
- HACKETT, H. BERKELEY**, Mechanical and Consulting Engineer, Public Ledger Building, 6th and Chestnut Streets, Philadelphia, Pennsylvania.
- HAGAR, WALTER F., Jr.**, Manufacturer, The Hagar Company, Ambler, Pennsylvania.
- HAINES, CASPAR WISTAR**, Civil Engineer, 6026 Germantown Avenue, Philadelphia, Pennsylvania.
- HAINES, ROBERT B., Jr.**, Manufacturer of Rolling Mill Gauges and Haines' Automatic Micrometer, 156 West School Lane, Germantown, Philadelphia, Pennsylvania.
- HAINES, WILLIAM A.**, Manufacturer of Fancy Leather Goods, 238 Allen Lane, Mount Airy, Philadelphia, Pennsylvania.
- HALE, HENRY S.**, Address unknown.
- HALL, C. A.**, Chemical Engineer, 7951 Winston Road, Chestnut Hill, Philadelphia, Pennsylvania.
- HALL, GEORGE R.**, 718 Widener Building, Philadelphia, Pennsylvania.
- HALL, R. T.**, Rear-Admiral, U. S. N., P. O. Box 228, Wynnwood, Pennsylvania.
- HALLBERG, JOSEF HENRIK**, Electrical Expert, 445 Riverside Drive, New York City, New York.
- HALSEY, WILLIAM B.**, Electrical Engineer, 9120 Ninety-seventh Street, Woodhaven, New York.
- HAMILTON, Major WILLIAM B.**, Mechanical Engineer, Hardier Tynes Manufacturing Company, Birmingham, Alabama.
- HAMMER, EDWIN W.**, Consulting Engineer, 55 John Street, New York City, New York.
- HAMMER, WILLIAM J.**, Consulting Electrical Engineer, Hotel Earle, 103 Waverly Place, New York City, New York.
- HAMMOND, JOHN M.**, The Phototechnical Laboratory, 703 Fourteenth Street, N. E. Washington, D.C.
- HANTHORN, JOSEPH R.**, Mechanical Engineer, 4135 Girard Avenue, Philadelphia, Pennsylvania.
- HARMAN, JOHN J.**, Mechanical Engineer, Walworth Manufacturing Company, Box 26, Boston, Massachusetts.
- HARRIS, BERT M.**, American Engineering Company, Philadelphia, Pennsylvania, and for mail, 5115 Hutchinson Street, Philadelphia, Pennsylvania.
- HARRIS, FRANKLIN M.**, Address unknown.
- HARRISON, ALFRED C.**, Retired Sugar Refiner, 1806 Packard Building, Philadelphia, Pennsylvania.
- HARRISON, Dr. CHARLES C.** (Retired), 1520 Locust Street, Philadelphia, Pennsylvania.
- HARRISON, GEORGE L.** (Retired), 1704 Locust Street, Philadelphia, Pennsylvania.
- HARRISON, J. K. M.**, Engineer, Harrison and Company, Land Title Building, Philadelphia, Pennsylvania.
- HARRISON, MITCHELL**, Financier, Nokesville, Virginia.
- HARRISON, THOMAS RANDOLPH**, Research Manager, The Brown Instrument Company, Philadelphia, Pennsylvania.
- HARSCH, JOHN W.**, Research Engineer, Leeds and Northrup Company, 4901 Stenton Avenue, Philadelphia, Pennsylvania.
- HART, CHARLES**, President, Delaware River Steel Company, Chester, Pennsylvania.
- HART, EDWARD**, Professor of Chemistry, Lafayette College, Easton, Pennsylvania.
- HARTNESS, JAMES**, President, Jones and Lamson Machine Company, and for mail, 30 Orchard Street, Springfield, Vermont.
- HARTUNG, ADOLPH**, Paper Merchant, 506 Race Street, Philadelphia, Pennsylvania.
- HARTZEL, FRANCIS W.**, Carburetted Water Gas Manufacturer, 414 Hellerman Street, Philadelphia, Pennsylvania.
- HARVEY, RICHARD P.**, Engineering Specialties, Hotel Medford, Milwaukee, Wisconsin.

- HASCHKA, FERD. T.**, Watchmaker, Tiffany and Company, and for mail, 135 West 78th Street, New York City, New York.
- HATTON, T. CHALKLEY**, Chief Engineer, Sewage Commission, 490 Broadway, Milwaukee, Wisconsin.
- HAUPT, Professor LEWIS M.**, Consulting Engineer, Cynwyd, Pennsylvania.
- HAWKINS, J. DAWSON**, Metallurgist, Colorado Springs, Colorado.
- HAYNER, J. HALMER**, Chemical Engineer, Leeds and Northrup Company, 4901 Stenton Avenue, and for mail, 7000 Lincoln Drive, Lincoln Terrace Apartments, Philadelphia, Pennsylvania.
- HAYWARD, NATHAN**, President, American Dredging Company, 308 Chestnut Street, Philadelphia, Pennsylvania.
- HAZEN, ALLEN**, 23 West 43rd Street, New York City, New York.
- HEILMAN, D. B.**, Safety Engineer, P. O. Box 453, Reading, Pennsylvania.
- HEILPRIN, WILLIAM A.**, Machinery Merchant and Engineer, 124 North 3rd Street, Philadelphia, Pennsylvania.
- HEISER, C. E.**, Assistant Electrical Engineer, Reading Company, 501 Ritter Street, Reading, Pennsylvania.
- HEITMAN, EDWARD**, Electrical Engineer, "Lee Crest" Second and Blaine Streets, Detroit, Michigan.
- HELME, WILLIAM E.**, Manufacturer, 700 Bulletin Building, Philadelphia, Pennsylvania.
- HENDRICK, Dr. ELWOOD**, Chemist, Author, 139 East 40th Street, New York City, New York.
- HENSEL, W. G.**, Student in Chemical Engineering, 403 North Cove Road, Merchantville, New Jersey.
- HENDRIXSON, L. H.**, Bell Telephone Company of Pennsylvania, 1835 Arch Street, Philadelphia, Pennsylvania.
- HENSON, EDWARD FRANCIS**, Lumber Merchant, Lafayette Building, 5th and Chestnut Streets, Philadelphia, Pennsylvania.
- HENTZ, ROBERT ALEXANDER**, Electrical Engineer, Philadelphia, Electric Company, 1000 Chestnut Street, and for mail, 556 South 48th Street, Philadelphia, Pennsylvania.
- HEPBURN, Dr. JOSEPH SAMUEL**, Associate Professor of Chemistry, Biological Chemist, Constantine Hering Laboratory, Hahnemann Medical College, 220 North Broad Street, Philadelphia, Pennsylvania.
- HERING, WALTER E.**, President, The Globe Ticket Company, 112 North 12th Street, Philadelphia, Pennsylvania.
- HERR, EDWIN M.**, President, Westinghouse Electric and Manufacturing Company, Westinghouse Building, 150 Broadway, New York City, New York.
- HERRESHOFF, NATHANIEL G.**, Naval Architect and Marine Engineer, 6 Walley Street, Bristol, Rhode Island.
- HERSAM, ERNEST A.**, Professor of Metallurgy, University of California, Berkeley, California.
- HERSEY, MAYO D.**, Physicist, U. S. Bureau of Standards, Washington, D.C.
- HERTY, Dr. CHARLES H.**, Chemist, The Chemical Foundation, Incorporated, 85 Beaver Street, New York City, New York.
- HESS, JOSEPH C. Jr.**, Assistant Superintendent, Leeds and Northrup Company, 4901 Stenton Avenue, Philadelphia, Pennsylvania.
- HETZEL, FREDERIC V.**, Mechanical Engineer, P. O. Box 366, West Chester, Pennsylvania.
- HICKS, THOMAS W.**, Manufacturer of Farm Implements, 4516 Fremont Avenue, South Minneapolis, Minnesota.
- HIERGESELL, VALENTINE**, Scientific Instrument Maker, 2007-13 Bellevue Avenue, Philadelphia, Pennsylvania.
- HIGGINS, EDMUND SAFFORD**, General Manager, Yellow Cab Company, 1734 North Broad Street, Philadelphia, Pennsylvania.
- HILL, ROY LINDEN**, Chemist, Atlas Powder Company, Tamaqua, Pennsylvania.
- HIRES, CHARLES E.**, Manufacturing Chemist, 206 South 24th Street, Philadelphia, Pennsylvania.
- HIRSCHLAND, FRANZ HERBERY**, President, Metal and Thermit Corporation, 120 Broadway, New York City, New York.
- HITCHCOCK, Dr. FANNY R. M.**, 37 Maple Avenue, Warwick, New York.
- HOADLEY, ANTHONY de H.**, Instructor of Civil Engineering, Union College, Schenectady, New York.
- HOADLEY, Dr. GEORGE A.**, Secretary to Committee on Science and the Arts, The Franklin Institute, Philadelphia, Pennsylvania, and for mail, Swarthmore, Pennsylvania.
- HOFSTETTER, GEORGE**, Blank Book Maker, Lithographer, 1013 Filbert Street, Philadelphia, Pennsylvania.
- HOLLAND, WALTER E.**, Research Engineer, Philadelphia Storage Battery Company, Ontario and C. Streets, Philadelphia, Pennsylvania.
- HOLLANDER, CHARLES S.**, Chemist and Chemical Engineer, in care of Rohm and Haas Company, Bristol, Pennsylvania.
- HOLLISTER, S. C.**, Consulting Engineer, 311 Elm Avenue, Swarthmore, Pennsylvania.
- HOLMES, GEORGE R.**, Technical Journalist, 135 Garrison Avenue, Jersey City, New Jersey.
- HOLST, L. J. R.**, Mechanical Engineer, 26 Haward Road, Brookline, Upper Darby Post Office, Delaware County, Pennsylvania.
- HOMER, FRANCIS T.**, Lawyer, Riderwood, Maryland.
- HONAMAN, R. KARL**, Electrical Engineer, Development and Research Department, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
- HOOKER, SAMUEL C.**, Chemist and Sugar Refiner, 82 Remsen Street, Brooklyn, New York.
- HOPPING, ERNEST L.**, Mechanical Engineer, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- HORN, Dr. DAVID W.**, 616 Montgomery Avenue, Bryn Mawr, Pennsylvania.
- HORN, FRANKLIN S.**, Lunch Room Proprietor, 1515 Arch Street, Philadelphia, Pennsylvania.

- HORNSEY, JOHN W.**, Consulting Engineer, 2 Whitehall Court, London, S.W.1, England.
- HORTON, ROBERT E.**, Consulting Hydraulic Engineer, R. F. D. No. 1, Voorheesville, New York.
- HOSKINS, WILLIAM**, Chemist, Room 2009-2011 West Monroe Street, Chicago, Illinois.
- HOUSTON, JOHN J. L.**, Civil Engineer, Department of City Transit, 1211 Chestnut Street, Philadelphia, Pennsylvania, and for mail, 137 North 19th Street, Philadelphia, Pennsylvania.
- HOUSTON, SAMUEL F.**, Trustee, 512 Real Estate Trust Building, Philadelphia, Pennsylvania.
- HOWARD, A. C.**, Gas Engineer, 61 Broadway, New York City, New York.
- HOWARD, WILFRED**, Instructor in Physics, Academy of the New Church, Bryn Athyn, Pennsylvania.
- HOWE, ARTHUR W.**, Broker, 1811 Walnut Street, Philadelphia, Pennsylvania.
- HOWELL, JOHN W.**, Engineer, Lamp Works, General Electric Company, Harrison, New Jersey.
- POWER, Professor HARRY S.**, Physicist, Carnegie Institute of Technology, and for mail, 5709 Solway Street, Pittsburgh, Pennsylvania.
- HOWSON, CHARLES HENRY**, Patent Solicitor and Engineer, 32 South Broad Street, Philadelphia, Pennsylvania.
- HOWSON, MISSEMY E.**, Instructor in Physics, Glen Moore, Chester County, Pennsylvania.
- HOWSON, HENRY**, Patent Solicitor and Engineer, West End Trust Building, Philadelphia, Pennsylvania.
- HOWSON, RICHARD**, 32 South Broad Street, Philadelphia, Pennsylvania.
- HOY, R. V. Jr.**, Bell Telephone Company of Pennsylvania, 1631 Arch Street, Philadelphia, Pennsylvania.
- HUBER, D. M.**, Bell Telephone Company, 1835 Arch Street, Philadelphia, Pennsylvania.
- HUFF, ERNEST L.**, Commercial Manager, Monongahela, West Pennsylvania Public Service Company, Fairmont, Box 1115, West Virginia.
- HUGHES, R. J.**, Iron Manufacturer, 1701 North Delaware Avenue, Philadelphia, Pennsylvania.
- HUMMEL, WILLARD A.**, American Engineering Company, 5049 Hawthorne Street, Philadelphia, Pennsylvania.
- HUMPHREYS, ALEXANDER C.**, Consulting Engineer, President, Stevens Institute of Technology, Hoboken, New Jersey.
- HUMPHREYS, Dr. W. J.**, Physicist, Weather Bureau, Washington, D. C.
- HURST, WILLIAM**, Apprentice, Bartol Research Foundation of The Franklin Institute, 127 North 19th Street, and for mail, 2513 North Cleveland Avenue, Philadelphia, Pennsylvania.
- HUSTON, CHARLES L.**, Vice-President, Lukens Steel Company, Coatesville, Pennsylvania.
- HUTCHINSON, S. PEMBERTON**, President, Westmoreland Coal Company, 224 South 3rd Street, Philadelphia, Pennsylvania.
- HUTTINGER, W. R.**, Mechanical Engineer, 86 East Greenwood Avenue, Lansdowne, Pennsylvania.
- HYATT, CLINTON BROWN**, Radio Experimenter, Melrose Park, Pennsylvania.
- HYMAN, JULIUS DANIELS**, Student, 2230 North Park Avenue, Philadelphia, Pennsylvania.
- IDDLIS, ALFRED**, Engineer, Day and Zimmermann, 1600 Walnut Street, Philadelphia, Pennsylvania.
- INDAHL, MAURITZ C.**, Mechanical Engineer, 248 East Johnson Street, Philadelphia, Pennsylvania.
- INGERSOLL, CHARLES EDWARD**, Attorney-at-Law, President, Central National Bank, 5th and Chestnut Streets, Philadelphia, Pennsylvania.
- INSULL, SAMUEL**, President, Commonwealth Edison Company, 72 West Adams Street, Chicago, Illinois.
- IRISH, WILLIAM MITCHELL**, Vice-President and General Manager, The Atlantic Refining Company, 260 South Broad Street, Philadelphia, Pennsylvania.
- IRONS, ROBERT HATFIELD**, President, Central Iron and Steel Company, Harrisburg, Pennsylvania.
- ISRAEL, JOSEPH D.**, District Manager, The Philadelphia Electric Company, 10th and Chestnut Streets, Philadelphia, Pennsylvania.
- ITTNER, MARTIN HILL**, Chief Chemist, Colgate and Company, Jersey City, New Jersey.
- IVES, FRED E.**, Inventor, 1808 North Park Avenue, Philadelphia, Pennsylvania.
- IVES, Dr. HERBERT E.**, Physicist, in care of Western Electric Company, 463 West Street, New York City, New York.
- JACKSON, Dr. JOHN PRICE**, Room 702, New York Edison Company, Irving Place and 15th Street, New York City, New York.
- JACKSON, WILLIAM STEELL**, Patent Attorney, 1001 Chestnut Street, Philadelphia, Pennsylvania.
- JACOBUS, D. S.**, Advisory Engineer, The Babcock and Wilcox Company, 85 Liberty Street, New York City, New York.
- JAMES, WILLIAM FOY**, Manager, Industrial Division Philadelphia Office, Westinghouse Electric and Manufacturing Company, and for mail, 6920 Boyer Street, Mount Airy, Philadelphia, Pennsylvania.
- JEANES, ISAAC W.**, Room 908, Lafayette Building, Philadelphia, Pennsylvania.
- JEFFERSON, J. P.**, Manufacturer, P. O. Box 645, Santa Barbara, California.
- JEFFERIES, ZAY**, Consulting Metallurgist, Aluminum Company of America, 2210 Harvard Avenue, Cleveland, Ohio.
- JENKINS, C. FRANCIS**, Inventor, 5502 16th Street, N. W., Washington, D. C.
- JENKINS, THEODORE F.**, Attorney-at-Law, 1100 Liberty Building, Broad and Chestnut Streets, Philadelphia, Pennsylvania.
- JENNINGS, W. N.**, Business Photographer, 45 South 17th Street, Philadelphia, Pennsylvania.
- JOB, ROBERT**, Vice-President, Milton Hersey Company, Limited, 84 St. Antoine Street, Montreal, Quebec, Canada.

- JODIDI, Dr. SAMUEL L., Chemist, U. S. Department of Agriculture, Washington, D. C.
- JOHANSEN, ERNST, Chemist, New England Oil Refining Company, Fall River, Massachusetts.
- JOHNSON, CLARENCE NATHAN, Electrical Engineer, Westinghouse Electric and Manufacturing Company, 30th and Walnut Streets, Philadelphia, Pennsylvania.
- JOHNSON, ERNEST EDWARD, Professor of Physics, Northeast High School, Philadelphia, Pennsylvania, and for mail, 5850 North 6th Street, Philadelphia, Pennsylvania.
- JOHNSON, JAMES CURTIS, General Superintendent of Telegraph, Pennsylvania Railroad Company, 812 Fox Building, Philadelphia, Pennsylvania.
- JOHNSON, WALTER H., President, Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- JOHNSON, WILLIAM A., President, Williams, Brown and Earle, 918 Chestnut Street, Philadelphia, Pennsylvania.
- JOHNSTON, JOHN, Chemist, Sterling Laboratory, Yale University, New Haven, Connecticut.
- JONES, JONATHAN, Engineer, P. O. Box 1593, Pittsburgh, Pennsylvania.
- JONES, JULIAN D., Superintendent, Telegraph and Signals, Eastern Region, Pennsylvania System, Room 152, Broad Street Station, Philadelphia, Pennsylvania.
- JONES, PHILIP CHAPIN, Electrical Engineer, Goodyear Tire and Rubber Company, Akron, Ohio, and for mail, 514 Barwell Street, Akron, Ohio.
- JONES, W. CLYDE, Attorney-at-Law, 77 West Washington Street, Chicago, Illinois.
- JUNKERSFELD, PETER, Engineering and Construction, 68 Trinity Place, New York City, New York.
- JUSTI, HENRY M., 32nd and Spring Garden Streets, Philadelphia, Pennsylvania.
- KABAKJIAN, Dr. D. H., Assistant Professor of Physics, University of Pennsylvania, Philadelphia, Pennsylvania.
- KALTENTHALER, H. J., Manufacturer of Steam Specialties, 6457 Woodbine Avenue, Overbrook, Philadelphia, Pennsylvania.
- KARRER, ENOCH, Physicist, National Lamp Works of General Electric Company, Wire Division, 16207 Nelaview Avenue, Cleveland, Ohio.
- KAUFMANN, HERBERT M., Vice-President, Mutual Chemical Company of America, 270 Madison Avenue, New York City, New York.
- KAVANAUGH, WM. H., Professor of Experimental Engineering, Towne Scientific School, University of Pennsylvania, Philadelphia, Pennsylvania.
- KEAY, L. KENT, Textile Manufacturer, Clifton Heights, Pennsylvania, and for mail, 48 East Stewart Avenue, Lansdowne, Pennsylvania.
- KEEFER, WILLIAM B., Address unknown.
- KEITH, C. P., in care of W. G. Peters, 69 Van Antwerp Road, Schenectady, New York.
- KELLER, E. E., Engineer and Manufacturer, Braywood, Quarton Road, Birmingham, Michigan.
- KELLER, HARRY HEXAMER, Engineer, Jenkintown, Pennsylvania.
- KELLERS, CHARLES FREDERICK, 204 Steward Avenue, Jackson, Michigan.
- KELLEY, Dr. GEORGE L., Research Chemist, 6804 McCallum Street, Philadelphia, Pennsylvania.
- KELLOGG, HOSFORD D., Manager, The H. B. Smith Company, 49th and Grays Avenue, Philadelphia, Pennsylvania.
- KENNEDY, FRANK G., Jr., President, Logan Iron and Steel Company, 1218 Stephen Girard Building, and for mail, 2043 Spruce Street, Philadelphia, Pennsylvania.
- KENNEDY, JOHN H., Address unknown.
- KENNEDY, J. J., Consulting Engineer, 52 Broadway, New York City, New York.
- KENNEDY, M. C., Vice-President, Pennsylvania Railroad Company, Broad Street Station, Philadelphia, Pennsylvania.
- KENNELLY, Dr. A. E., Professor of Electrical Engineering, Harvard University, Cambridge, Massachusetts.
- KENT, A. ATWATER, Manufacturer, Ardmore, Pennsylvania.
- KENT, RUSSELL H., Mechanical Engineer, The Kent Manufacturing Company, Clifton Heights, Pennsylvania, and for mail, 102 South Rolling Road, Springfield, Pennsylvania.
- KENT, S. LEONARD, Jr., Hydro-Electrics, Manayunk, Philadelphia, Pennsylvania.
- KERCHER, M. A., Commercial Department, Bell Telephone Company, 1835 Arch Street, Philadelphia, Pennsylvania.
- KERLIN, W. D., Secretary and Treasurer, Camden Forge Company, Camden, New Jersey.
- KERR, WILLIAM M., Manufacturer, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- KETCHAM, O. W., Manufacturer of Architectural Terra Cotta, 125 North 18th Street, Philadelphia, Pennsylvania.
- KETTERLINUS, J. L., Lithographer, 4th and Arch Streets, Philadelphia, Pennsylvania.
- KILPATRICK, J. L., Fulton Towers, 78 Harrison Street, East Orange, New Jersey.
- KIMBER, WILLIAM M. C., Manufacturer of Electrical Instruments, 999 East Haines Street, Germantown, Philadelphia, Pennsylvania.
- KINEALY, JOHN HENRY, Consulting Engineer, 503 Granite Building, St. Louis, Missouri.
- KING, CHARLES W. G., Mechanical Engineer, 6201 Park Boulevard, Wildwood Crest, New Jersey.
- KING, JOSEPH B., Jr., Assistant in Research Laboratory, Electric Storage Battery Company, and for mail, 7315 Boyer Street, Mount Airy, Philadelphia, Pennsylvania.
- KINGSBURY, Dr. EDWIN F., Physicist, Western Electric Company, 463 West Street, New York City, New York.
- KINGSFORD, RUSSELL T., 808 Glenside Avenue, Wyncote, Pennsylvania.
- KINNARD, L. H., President, The Bell Telephone Company, 1631 Arch Street, Philadelphia, Pennsylvania.
- KINNIER, GEORGE E., Civil Engineer, 464 North New Street, Bethlehem, Pennsylvania.
- KINYON, ALONZO G., Combustion Engineer and Inventor, Fuller-Lehigh Company, Fullerton Pennsylvania.

- KIPPENBERG, HENRY**, in care of Merck and Company, Rahway, New Jersey.
- KIRSOPP, EDGAR C. B.**, Assistant Treasurer, Rohm and Haas Company, Inc., Bristol, Pennsylvania, and for mail, 40 North Front Street, Philadelphia, Pennsylvania.
- KISTLER, S. S.**, Professor of Chemistry, College of the Pacific, Stockton, California.
- KLEMM, J. GEORGE, Jr.**, Heating and Ventilating Engineer, Box 284, Haverford, Pennsylvania.
- KLINE, C. MAHLON**, Wholesale Druggist, 105 North 5th Street, Philadelphia, Pennsylvania.
- KLUMPP, JOHN BARTLEMAN**, Inspecting Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- KNAPP, ARTHUR**, Petroleum Engineer, Box 1902, Philadelphia, Pennsylvania.
- KNAPP, I. N.**, Engineer, 504 Aspen Street, N. W., Tacoma Park, Washington, D. C.
- KNEASS, STRICKLAND L.**, Mechanical Engineer, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- KNOEDLER, E. L.**, General Superintendent, The Welshbach Company, Gloucester, New Jersey.
- KNOX, HENRY HOBART**, Mining Engineer, 160 Broadway, New York City, New York.
- KOCH, EARL L.**, Research Engineer, 1511 Byron Street, Chicago, Illinois.
- KOCH, GEORGE B.**, General Foreman, South Altoona Foundries, Pennsylvania Railroad Company, Altoona, Pennsylvania.
- KOCH, JULIUS A.**, Professor of Chemistry and Dean of School of Pharmacy, University of Pittsburgh, Bluff and Pride Streets, Pittsburgh, Pennsylvania.
- KOHN, JOSEPH**, Secretary and Treasurer, Universal Dental Company, 5416 Woodcrest Avenue, Philadelphia, Pennsylvania.
- KOTHNY, G. L.**, Consulting Engineer, C. H. Wheeler Manufacturing Company, and for mail Woodland Road, Strafford, Pennsylvania.
- KRAMER, D. F.**, Signal Foreman, Atlantic Railroad, Reading Company, Camden, New Jersey.
- KRANZ, FRED WILLIAM**, Research Physicist, Geneva, Illinois.
- KRAUS, E. R.**, Engineering Department, Bell Telephone Company of Pennsylvania, 1835 Arch Street, Philadelphia, Pennsylvania.
- KRAUSS, GEORGE**, Chemical Engineer, 517 North Creighton Street, Philadelphia, Pennsylvania.
- KREBS, A. S.**, President, Krebs Pigment and Chemical Company, Newport, Delaware.
- KREBS, H. J.**, Chairman, Board of Directors, Krebs Pigment and Chemical Company, Newport, Delaware.
- KRETZ, JULIUS, Jr.**, 714 State Street, Camden, New Jersey.
- KRISCHKE, Mrs. R. H.**, Address unknown.
- KUBALE, JOHN CHARLES**, Electrical Engineer, 141 Trafalgar Square, Rochester, New York.
- KUCHEK, ANDREW ALBERT**, Consulting Engineer, Westinghouse Electric and Manufacturing Company, South Philadelphia, Pennsylvania, and for mail, 812 Glen Terrace, Chester, Pennsylvania.
- KUEHN, THEODORE**, 3232 North 26th Street, Philadelphia, Pennsylvania.
- KUSEL, Dr. GEORGE C.**, Dentist, 1614 Locust Street, Philadelphia, Pennsylvania.
- KUHN, C. HARTMAN**, 202 Liberty Building, Philadelphia, Pennsylvania.
- KUNSMAN, CHARLES H.**, Physicist, Fixed Nitrogen Research Laboratory, U. S. Department of Agriculture, Washington, D. C.
- KUNZ, Dr. GEORGE F.**, President, The American Scenic and Historic Preservation Society, 409 Fifth Avenue, New York City, New York.
- LAIRD, CLINTON N.**, Chemist, Lingnan University, Canton, China.
- LAMB, NEWTON**, Chemist, Penn Process Company, Incorporated, Mill and Church Roads, Elkins Park, Pennsylvania, and for mail, 349 Harrison Avenue, Elkins Park, Pennsylvania.
- LANDIS, DANIEL OBED**, 48 Fairview Avenue, Sellersville, Pennsylvania.
- LANDRETH, C. P.**, Manufacturer, Electrolytic Purification Company, 15th Street and Lehigh Avenue, Philadelphia, Pennsylvania.
- LANDT, Dr. GUSTAVE ERNEST**, Chemist, Diamond State Fibre Company, Bridgeport, Pennsylvania.
- LANZA, GAETANO**, Engineer, Special Consultant, The Baldwin Locomotive Works, Philadelphia, Pennsylvania, and for mail, 5624 Cedar Avenue, Philadelphia, Pennsylvania.
- LATHROP, ELBERT CLYDE**, Chemist, The Celotex Company, 645 North Michigan Avenue, Chicago, Illinois.
- LAUER, CONRAD**, General Manager, Day and Zimmermann, and for mail, 233 West Horner Street, Germantown, Philadelphia, Pennsylvania.
- LAVINO, E. J.**, Merchant, 471 Bullitt Building, Philadelphia, Pennsylvania.
- LAWALL, CHARLES H.**, Analytical Chemist, 636 Franklin Square, Philadelphia, Pennsylvania.
- LAWLER, G. S.**, Electrical Engineer, Associated Factory Mutual Fire Insurance Companies, Fort Hill Square, 184 High Street, Boston, Massachusetts.
- LAWRENCE, RUSSELL E.**, Dean of Engineering, University of Detroit, 630 East Jefferson Avenue, Detroit, Michigan.
- LAY, JOHN TRACY**, Research Assistant in Physics, University of Pennsylvania, and for mail, 4015 Pine Street, Philadelphia, Pennsylvania.
- LE BOUTILLIER, HENRY W.**, Chemist, Wayne, Pennsylvania.
- LE BOUTILLIER, ROBERT**, Wayne, Pennsylvania.
- LEDoux, J. W.**, Chief Engineer, American Pipe Manufacturing Company, 112 North Broad Street, Philadelphia, Pennsylvania.
- LEE, ELISHA**, Vice-President in Charge of Operation, Broad Street Station, Philadelphia, Pennsylvania.
- LEE, JAMES D., Jr.**, 5929 Greene Street, Germantown, Philadelphia, Pennsylvania.
- LEE, WALTER T.**, Accountant, 308 Rex Avenue, Chestnut Hill, Philadelphia, Pennsylvania.

- LEECH, THOMAS DAVID JAMES**, Civil Engineer, P. N. R. School, University of Sydney, New South Wales, Australia, and for mail, "Orontes," Clark Street, Granville, New South Wales, Australia.
- LEEDS, MORRIS E.**, Manufacturer of Scientific Instruments, 4901 Stenton Avenue, Germantown, Philadelphia, Pennsylvania.
- LEFFMANN, HENRY**, Chemist, The Franklin Institute, Philadelphia, Pennsylvania.
- LEIGHNINGER, WILLIAM B.**, Teacher of Chemistry, Frankford High School, and for mail, 236 West School Lane, Germantown, Philadelphia, Pennsylvania.
- LE MAISTRE, F. J.**, Chemical Engineer, 810 Bellevue Court Building, Philadelphia, Pennsylvania.
- LEMOINE, L. R.**, President, United States Cast Iron Pipe and Foundry Company, Morris Building, Philadelphia, Pennsylvania.
- LENHER, VICTOR**, Chemist, 1718 Summit Avenue, Madison, Wisconsin.
- LENKER, WILL G.**, Civil Engineer, 405 Chestnut Street, Sunbury, Pennsylvania.
- LEOPOLD, CHARLES S.**, Consulting Engineer, 213 South Broad Street, Philadelphia, Pennsylvania.
- LERCH, G. R.**, Air Brake Instructor, Reading Company, Reading, Pennsylvania.
- LESLEY, ROBERT W.**, Manufacturer, 612 Pennsylvania Building, Philadelphia, Pennsylvania.
- LEVY, HOWARD S.**, 1424 North 15th Street, Philadelphia, Pennsylvania.
- LEVY, LIONEL FARADAY**, Chemical Engineer, Wayne Avenue and Berkley Street, Germantown, Philadelphia, Pennsylvania.
- LEWIS, A. NELSON**, Attorney-at-Law, 1811 Walnut Street, Philadelphia, Pennsylvania.
- LEWIS, DANIEL C.**, Agent, The Millville Manufacturing Company, Millville, New Jersey.
- LEWIS, GEORGE W.**, Mechanical Engineer, National Advisory Committee for Aeronautics, 2722 Navy Building, Washington, D. C.
- LEWIS, HOWARD W.**, Banker, 1928 Spruce Street, Philadelphia, Pennsylvania.
- LEWIS, JOHN F.**, Attorney-at-Law, 208 South 4th Street, Philadelphia, Pennsylvania.
- LEWIS, N. B.**, New York Division, Reading Company, New York City, New York.
- LEWIS, NATHAN E.**, Mechanical Engineer, Babcock and Wilcox Company, 85 Liberty Street, New York City, New York.
- LEWIS, PAUL A.**, Physician, Rockefeller Institute for Medical Research, Department of Animal Pathology, Princeton, New Jersey.
- LEWIS, ROBERT B.**, Mechanical Engineer, 51 East Penn Street, Germantown, Philadelphia, Pennsylvania.
- LEWIS, WILFRED**, Mechanical Engineer, President, The Tabor Manufacturing Company, and for mail, Rose Lane, Haverford, Pennsylvania.
- LICHTENBERG, Captain CHESTER**, Electrical Engineer, 136 Waverly Place, Schenectady, New York.
- LIDBURY, FRANK AUSTIN**, President, Oldbury Electro-Chemical Company, P. O. Box 619, Niagara Falls, New York.
- LIEB, J. W.**, Vice-President, The New York Edison Company, 15th Street and Irving Place, New York City, New York.
- LIEBER, HUGO**, Chemist, President, H. Lieber and Company, 19 West 44th Street, New York City, New York.
- LIGHTFOOT, THOMAS M.**, Retired Educator, Chesham, New Hampshire.
- LIHME, I. P.**, Chemical Engineer, The Grasselli Chemical Company, Cleveland, Ohio.
- LILLBRIDGE, H. W.**, 402 West Stafford Street, Philadelphia, Pennsylvania.
- LILLIE, LEWIS**, Vice-President, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- LILLIE, S. MORRIS**, President, Sugar Apparatus Refining Company, 4804 Springfield Avenue, Philadelphia, Pennsylvania.
- LINDENTHAL, GUSTAV**, Consulting Engineer, Room 738, Pennsylvania R. R. Station, New York City, New York.
- LIPPINCOTT, J. BERTRAM**, Publisher, 227 South 6th Street, Philadelphia, Pennsylvania.
- LIPPINCOTT, JOSEPH W.**, Publisher, Bethayres, Pennsylvania.
- LITTLE, ARTHUR D.**, President, Arthur D. Little, Incorporated, 30 Charles River Road, Cambridge, Massachusetts.
- LITTLETON, WILLIAM GRAHAM**, Vice-President, Fidelity Trust Company, 325 Chestnut Street, Philadelphia, Pennsylvania.
- LIVERSIDGE, HORACE P.**, Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- LIVINGSTON, HERMAN**, Hydro Carbon Engineer, 1341 Marlborough Avenue, Plainfield, New Jersey.
- LLOYD, HERBERT**, President, Electric Storage Battery Company, Philadelphia, Pennsylvania.
- LLOYD, JOHN URI**, Manufacturing Pharmacist and Chemist, 300 West Court Street, Cincinnati, Ohio.
- LLOYD, MALCOLM Jr.**, Lawyer, 701 Commercial Trust Building, Philadelphia, Pennsylvania.
- LLOYD, MORTON G.**, Electrical Engineer, Bureau of Standards, Washington, D. C.
- LOBBEN, PEDER**, Mechanical Engineer, Room No. 2, Keyers Gade 1, Oslo, Norway.
- LOEB, LEO**, Mechanical Engineer, Albert B. Manuel, 61 Broadway, New York City, New York, and for mail, 302 Park Street, Montclair, New Jersey.
- LOGAN, LLOYD**, Research Associate, Gas Engineer, Room 29, Mechanical and Electrical Building, Johns Hopkins University, Baltimore, Maryland.
- LOHMANN, ALFRED PERKINS**, Engineer, 15 Railroad Avenue, Haverford, Pennsylvania.
- LONGERGAN, J. E.**, Brass Manufacturer, 211 Race Street, Philadelphia, Pennsylvania.
- LONGSTRETH, CHARLES**, 611 A Avenue, Coronado, California.
- LONGSTRETH, EDWARD T.**, Manufacturer, 6805 North 11th Street, Oak Lane, Philadelphia, Pennsylvania.

- LOOMIS, ALFRED L.**, Banker, 25 Nassau Street, New York City, New York, and for mail, Tuxedo Park, New York.
- LORENTZ, HENDRIK A.**, Physicist, Zylweg 76, Haarlem, Holland.
- LOSS, HENRIK VON ZERNIKOW**, Consulting Engineer, Hotel Bristol, Oslo, Norway.
- LOVEJOY, J. R.**, Vice-President, General Electric Company, Schenectady, New York.
- LOVEKIN, LUTHER D.**, Marine Engineer, 360 Penn Road, Wynnewood, Pennsylvania.
- LOWE, ARTHUR W.**, Public School Teacher, 1224 Herbert Street, Frankford, Philadelphia, Pennsylvania.
- LOWER, NATHAN M.**, Assistant General Manager, Locomotive Stoker Company, 292 Balph Avenue, Bellevue, Pennsylvania.
- LOYD, SARAH A. C.**, 1206 Filbert Street, Philadelphia, Pennsylvania.
- LUCAS, FRANCIS F.**, Engineer, Bell Telephone Laboratories, Incorporated, 463 West Street, New York City, New York.
- LUCKE, CHARLES EDWARD**, Professor of Mechanical Engineering, Columbia University, New York City, New York.
- LUCKIESH, Dr. M.**, Director Lighting Research Laboratory, Nela Park, Cleveland, Ohio.
- LUKENS, Dr. HIRAM S.**, Chemist, Harrison Laboratory, University of Pennsylvania, 34th and Spruce Streets, Philadelphia, Pennsylvania.
- LUPTON, EDWARD**, Manufacturer of Sheet Metal, Allegheny Avenue and Tulip Street, Philadelphia, Pennsylvania.
- LYMAN, JAMES**, Consulting Engineer, Member of Firm, Sargent and Lundy, 1412 Edison Building, Chicago, Illinois.
- LYNCH, JOHN COOPER**, Assistant Vice-President, American Telephone and Telegraph Company, 195 Broadway, New York City, New York.
- LYON, PERCY S.**, Chief Engineer, Cochrane Corporation, 17th Street and Allegheny Avenue, Philadelphia, Pennsylvania.
- LYSLE, FREDERIC BOWERS**, Chemist-Engineer, 906 Colonial Trust Building, Philadelphia, Pennsylvania.
- MCALLISTER, T. S.**, Commercial Department, The Bell Telephone Company, 1835 Arch Street, Philadelphia, Pennsylvania.
- MCCARTHUR, GEORGE P.**, Mechanical Engineer, Joseph Oat and Sons, 232 Quarry Street, Philadelphia, Pennsylvania.
- MCBRIDE, THOS. C.**, Sales Manager, Worthington Pump and Machinery Corporation, 1516 North American Building, Philadelphia, Pennsylvania.
- MCCAIN, GEORGE NOX**, Editor, The Evening Bulletin, and for mail, 4008 Pine Street, Philadelphia, Pennsylvania.
- MCCALL, GEORGE**, Address unknown.
- MCCALL, RICHARD**, The Touraine, 16th and Spruce Streets, Philadelphia, Pennsylvania.
- MCCLENAHAN, JOHN MEGREDY, 2nd**, Montgomery Avenue, Villanova, Pennsylvania.
- MCCONNELL, FRANKLIN P.**, Day and Zimmermann, Incorporated, 1600 Walnut Street, Philadelphia, Pennsylvania, and for mail, 706 Spruce Street, Philadelphia, Pennsylvania.
- MCCORMACK, H.**, Professor of Chemical Engineering, Armour Institute of Technology, Chicago, Illinois.
- MCCORMICK, WILLIAM**, Assistant Engineer, Reading Company, Reading Terminal, Philadelphia, Pennsylvania.
- MCDONALD, HUNTER**, Chief Engineer, N. C. and St. L. Ry. Company, 924 Broadway, Nashville, Tennessee.
- MCDOWELL, CHARLES**, Paper Manufacturer, Main and Levering Streets, Manayunk, and for mail, 5804 Greene Street, Germantown, Philadelphia, Pennsylvania.
- McFARLANE, M. L. D.**, Engineer, 25 Park Place, New York City, New York.
- McGEORGE, PERCY**, 711 Bullitt Building, Philadelphia, Pennsylvania.
- McGOWAN, J. Jr.**, Assistant General Manager, Campbell Soup Company, 2nd and Market Streets, Camden, New Jersey.
- McKAIG, W. WALLACE**, Mechanical Engineer, Cumberland, Maryland.
- McKEEHAN, Dr. L. W.**, Research Physicist, Western Electric Company, 463 West Street, New York City, New York.
- McLEAN, WILLIAM L.**, Publisher, The Evening Bulletin, Philadelphia, Pennsylvania.
- McMEEKIN, Major C. W.**, 2218 Roosevelt Avenue, Berkeley, California.
- McVEY, JOHN JOSEPH**, Publisher and Bookseller, 1229 Arch Street, Philadelphia, Pennsylvania.
- MACALPIN, J. KENNETH W.**, Chemistry Teacher, New York University, New York City, and for mail, 8 Beekman Avenue, Mount Vernon, New York.
- MacBAIN, D. R.**, Assistant General Manager, New York Central Railroad Company, Cleveland, Ohio.
- MacBETH, NORMAN**, Illuminating Engineer, 227 West 17th Street, New York City, New York.
- MacFARLANE, JOHN M.**, Professor of Botany, University of Pennsylvania, and for mail, 4320 Osage Avenue, Philadelphia, Pennsylvania.
- MacGREGOR, FRANK S.**, Development Department, E. I. duPont de Nemours and Company, 8065 duPont Building, Wilmington, Delaware.
- MACKENZIE, K. G.**, Consulting Chemist, The Texas Company, 17 Battery Place, New York City, New York.
- MacLEAN, L. W.**, Electrical Supervisor, Reading Company, Reading, Pennsylvania.
- MacMURPHY, F.**, 1401 South Hope Street, Los Angeles, California.
- MADEIRA, PERCY C.**, Coal Operator, North American Building, Philadelphia, Pennsylvania.
- MAILLOUX, Dr. C. O.**, Consulting Engineer, 111 Fifth Avenue, New York City, New York.
- MAIZLISH, Dr. ISRAEL**, Instructor in Physics, Centenary College, Shreveport, Louisiana.
- MALLERY, OTTO, T.**, Economist, 112 South 16th Street, Philadelphia, Pennsylvania.

- MALLINCKRODT, E., Jr.**, Manufacturing Chemist, Mallinckrodt Chemical Works, St. Louis, Missouri.
- MANKER, FORREST WILLIAM**, Vice-President, Senferer Combustion Company, 366 Gerald Avenue, New York City, New York.
- MANNING, EUGENE REYNOLDS**, Chemical Engineer, Harrison Laboratory, University of Pennsylvania, Philadelphia, and for mail, 32 West Ridley Avenue, Ridley Park, Pennsylvania.
- MANNING, J. H.**, Vice-President, Stone and Webster Company, Inc., 120 Broadway, New York City, New York.
- MANWARING, ALBERT H.**, Electrical Engineer, The Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- MARBAKER, Dr. EDWARD**, Chemist, Mellon Institute, Pittsburgh, Pennsylvania.
- MARCONI, GUGLIELMO**, Senator, Electrical Engineer and Inventor, 31 Via Garibaldi Gianicolo, Rome, Italy.
- MARKLE, A.**, Mining Engineer, Hazleton, Pennsylvania.
- MARSHALL, J. T. W.**, Research Department, Victor Talking Machine Company, Camden, New Jersey, and for mail, 1718 Pine Street, Philadelphia, Pennsylvania.
- MARTIN, THOMAS S., 3rd**, Civil Engineer, 7205 Cresheim Road, Germantown, Philadelphia, Pennsylvania.
- MARTOCELLO, JOSEPH A.**, Manufacturer Raw Water Ice Making Appliances, 229 North 13th Street, Philadelphia, Pennsylvania.
- MASLAND, CHARLES H., 2nd**, Chemical Engineer, 1128 Foulkrod Street, Frankford, Philadelphia, Pennsylvania.
- MASON, CHARLES THOMAS**, Electrical Engineer, President, Sumter Electric Company, Sumter, South Carolina.
- MASON, SIDNEY**, President, Welsbach Company, Gloucester City, New Jersey.
- MASON, WILLIAM CLARKE**, Attorney-at-law, 934 Land Title Building, Philadelphia, Pennsylvania.
- MASON, W. P.**, Professor of Chemistry, Rensselaer Polytechnic Institute, Troy, New York.
- MASTERS, Major FRANK M.**, Consulting Engineer, Calder Building, Harrisburg, Pennsylvania.
- MATHESON, HOWARD WATSON**, Chemist and Chemical Engineer, 611 Power Building, Montreal, Quebec, Canada.
- MATHEWS, Dr. JOSEPH HOWARD**, Professor in Chemistry, University of Wisconsin, Madison, Wisconsin.
- MATTHEWS, W. G.**, Address unknown.
- MATUNAGA, YOSINOBU**, Physicist, Shibaura Engineering Works, Kanasugi, Shiba, Tokyo, Japan.
- MAURY, MATTHEW F.**, Banker, 807 Packard Building, Philadelphia, Pennsylvania.
- MAXFIELD, H. H.**, General Superintendent, Pennsylvania System, 402 Pennsylvania Building, Wilmington, Delaware.
- MAYER, NELSON B.**, Merchant, Hotel Gladstone, 114 East 52nd Street, New York City, New York.
- MEARS, ATHERTON H.**, Physicist, Leeds and Northrup Company, and for mail, 256 East Penn Street, Germantown, Philadelphia, Pennsylvania.
- MEASEY, WILLIAM MAUL**, Attorney-at-Law, 1328 Chestnut Street, Philadelphia, and for mail, Box 208, Haverford, Pennsylvania.
- MEEKER, G. H.**, Professor of Chemistry, School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania.
- MEES, C. E. K.**, Director of Research, Eastman Kodak Company, Kodak Park Works, Rochester, New York.
- MELCHER, WM. C. Jr.**, Care of Pelton Water Wheel Company, 100 Broadway, New York City, New York.
- MELLOR, NORMAN**, Manufacturer, Wayne Junction, Philadelphia, Pennsylvania.
- MELODY, MICHAEL**, Bailey Building, Philadelphia, Pennsylvania.
- MERRICK, JAMES HARTLEY**, Director of Welfare, University of Pennsylvania, and for mail, Hotel Pennsylvania, 3900 Chestnut Street, Philadelphia, Pennsylvania.
- MERRICK, J. V.**, 253 South 16th Street, Philadelphia, Pennsylvania.
- MERRIMAN, THADDEUS**, Chief Engineer, Board of Water Supply, Municipal Building, New York City, New York.
- MERRITT, JAMES SMITH**, Mechanical Engineer, Abington, Pennsylvania.
- MERSHON, R. D.**, Consulting Engineer, 80th Street and East End Avenue, New York City, New York.
- MERZ, CHARLES H.**, Consulting Engineering, 32 Victoria Street, London, S. W., England.
- MERZ, EUGENE**, Manufacturer, The Heller and Merz Company, 503 Hudson Street, New York City, New York.
- METTEN, JOHN F.**, Chief Engineer, Wm. Cramp and Sons Ship and Engine Building Company, Richmond and Norris Streets, Philadelphia, Pennsylvania.
- METZ, HERMAN A.**, Manufacturer and Importer of Chemicals and Dyestuffs, 122 Hudson Street, New York City, New York.
- MICHELSON, A. A.**, Professor of Physics, University of Chicago, Chicago, Illinois.
- MIDDLETON, ALBERT C.**, Director, 149 East Main Street, Moorestown, New Jersey.
- MILES, J. WALTER**, Electrical Engineer, Irwin, Pennsylvania.
- MILLER, CASPER W.**, Physician, Wallingford, Pennsylvania.
- MILLER, FRED J.**, Factory Manager, New Hope, Pennsylvania.
- MILLER, Dr. JOHN M.**, 4700 Wissahickon Avenue, Philadelphia, Pennsylvania.
- MILLER, SIMON**, Textile Manufacturer, 1530 Locust Street, 5-B, Philadelphia, Pennsylvania.
- MILLER, W. LASH**, Professor of Physical Chemistry, 8 Hawthorne Avenue, Toronto, 5, Canada.
- MILLIKEN, J.**, President, Pittsburgh Testing Laboratories, P. O. Box 1115, Pittsburgh, Pennsylvania.

- MILLS, GEO. M.**, President, Thomas Mills and Brothers, Incorporated, 1301 North 8th Street, Philadelphia, Pennsylvania.
- MILNE, DAVID**, Manufacturer, School House Lane, Germantown, Philadelphia, Pennsylvania.
- MILNE, FRANCIS F., Jr.**, 1714 Spruce Street, Philadelphia, Pennsylvania.
- MILNER, ROBERT DENNISTON**, Salesman, Leeds and Northrup Company, 4901 Stenton Avenue, Philadelphia, Pennsylvania.
- MINER, Dr. HARLAN S.**, Chief Chemist, Welsbach Company, Gloucester, New Jersey.
- MISSIMER, GEORGE, Jr.**, Farmer, West Port Royal Avenue, Roxborough, Philadelphia, Pennsylvania.
- MITCHELL, HENRY F.**, Glazed Kid Manufacturer, 36th and Reed Streets, Philadelphia, Pennsylvania.
- MITCHELL, Dr. WALTER M.**, Metallurgical Engineer, Development Division, Central Alloy Steel Corporation, Massillon, Ohio.
- MITTEN, T. E.**, Chairman of Executive Committee, Philadelphia Rapid Transit Company, 1520 Spruce Street, Philadelphia, Pennsylvania.
- MIXER, CHARLES A.**, Engineer, Rumford Falls Power Company, Rumford, Maine.
- MOAT, DONALD E.**, Sales Engineer, Leeds and Northrup Company, 4901 Stenton Avenue, Philadelphia, Pennsylvania.
- MODJESKI, RALPH**, Consulting Civil Engineer, 818 Widener Building, Philadelphia, Pennsylvania.
- MONROE, WILLIAM STANTON**, President, Sargent and Lundy, Inc., 1412 Edison Building, Chicago, Illinois.
- MOODY, LEWIS FERRY**, Consulting Engineer, William Cramp and Sons Ship and Engine Building Company, Richmond and Norris Streets, Philadelphia, Pennsylvania.
- MOORE, COLEMAN B.**, Haverford, Pennsylvania.
- MOORE, DAVID PELTON**, Patent Attorney, Warder Building, Washington, D. C.
- MOORE, HORACE E.**, Superintendent, Chester Heights, Delaware County, Pennsylvania.
- MOORE, W. E.**, President, W. E. Moore and Company, Engineers, Room 706, Union Bank Building, Pittsburgh, Pennsylvania.
- MOOREHOUSE, J. W.**, Electrical Supervisor, Reading Company, Reading, Pennsylvania.
- MORAN, DANIEL E.**, 9 East 45th Street, New York City, New York.
- MORAN, ROBERT (Retired)**, Rosario, San Juan County, Washington.
- MORGAN, Dr. JAMES DOUGLASS**, Physician, 2226 Delancey Street, Philadelphia, Pennsylvania.
- MORGAN, MARSHALL S.**, Fidelity-Philadelphia Trust Company, 325 Chestnut Street, Philadelphia, Pennsylvania.
- MORRIS, A. SAUNDERS**, Mechanical Engineer, Haverford, Pennsylvania.
- MORRIS, ALBERT WOOD**, Consulting Engineer, 54 Buckingham Street, Springfield, Massachusetts.
- MORRIS, EFFINGHAM B.**, Girard Trust Company, Philadelphia, Pennsylvania.
- MORRISSEY, JOHN P.**, Professor of Chemistry, 651 East Jefferson Avenue, Detroit, Michigan.
- MORSE, WITHROW**, Professor Physiological Chemistry and Toxicology, Jefferson Medical College, 1001 Walnut Street, Philadelphia, Pennsylvania.
- MOYER, J. A.**, Director, Massachusetts Board of Education, State House, Boston, Massachusetts.
- MULL, J. HARRY**, President and General Manager, The William Cramp and Sons Ship and Engine Building Company, Richmond and Norris Streets, Philadelphia, Pennsylvania.
- MULLER, EDWARD ALBERT**, Vice-President and Secretary, The King Machine Tool Company, Winton Place, Cincinnati, Ohio.
- MULLER, RALPH H.**, Chemical Engineer, Apartment 6-0, 651 West 188th Street, New York City, New York.
- MURDOCK, JOSEPH B.**, Rear-Admiral, U. S. N. (Retired), Danbury, New Hampshire.
- MURPHY, PETER H.**, Address unknown.
- MURRAY, B. L.**, Chemist, Merck and Company, Rahway, New Jersey.
- MURRAY, HENRY H.**, Mechanical Engineer, Victor Talking Machine Company, Camden, New Jersey, and for mail, 204 Lippincott Avenue, Riverton, New Jersey.
- MURRAY, J. F.**, Assistant to Chief Engineer, Pennsylvania Railroad Company, 607 Broad Street Station, Philadelphia, Pennsylvania.
- MURRAY, THOMAS E.**, Consulting Electrical Engineer, 124 East 15th Street, New York City, New York.
- MURRAY, WILLIAM S.**, Consulting Engineer, Room 5601, Grand Central Terminal, New York City, New York.
- NAKAMOURA, H.**, Radio Engineer, Research Laboratory, The Tokyo Electric Company Limited, Kawasaki, Kanagawa-Ken, Japan.
- NEBELTE, CAROL BERNARD**, Department of Photography, Texas A. and M. College, College Station, Texas.
- NEILER, SAMUEL G.**, Consulting Mechanical and Electrical Engineer, 1409 Manhattan Building, Chicago, Illinois.
- NETHERY, HARRY J. W.**, Research Department, Leeds and Northrup Company, and for mail, 1123 West Third Street, Chester, Pennsylvania.
- NETHERY, JOHN E.** (Retired), Address unknown.
- NEWBOLD, CLEMENT BUCKLEY, Jr.**, Student, Princeton University, Princeton, New Jersey, and for mail, Crosswicks House, Jenkintown, Pennsylvania.
- NICE, EUGENE E.**, Manufacturer, 272 South 2nd Street, Philadelphia, Pennsylvania.
- NICHOLS, CARROLL B.**, 1214 Widener Building, Philadelphia, Pennsylvania.
- NICHOLS, EDGARBYRON**, 524 Wellington Avenue, Rochester, New York.
- NICHOLS, LEON W.**, Chemist, Glenolden, Pennsylvania.
- NICHOLS, Dr. WILLIAM H.**, Consulting Chemist, Chairman of Board of Directors, The Allied Chemical and Dye Corporation, 61 Broadway, New York City, New York.
- NIELSON, DAVID**, 350 Johnson Street, Bristol, Pennsylvania.

- NIGHTINGALE, DONALD ARCHER**, Chemist, Ambler, Pennsylvania.
- NORDHAUS, CHARLES H.**, Radio Experimenter, Neway Radio Sales, 3943 Lawrence Avenue, Chicago, Illinois.
- NORMAN, BRADFORD**, Farmer, Newport, Rhode Island.
- NORMAN, REGINALD**, Farmer, Newport, Rhode Island.
- NORRIS, GEORGE L.**, Tool Specialist, 222 West 2nd Street, Wilmington, Delaware.
- NORTH, R. H.**, North Brothers Manufacturing Company, Lehigh Avenue and American Street, Philadelphia, Pennsylvania.
- NORTHROP, EDWIN FITCH**, Research Physicist, Palmer Physical Laboratory, Princeton, New Jersey.
- NOYES, STEPHEN H.**, Civil Engineer, Assistant to Chief Engineer, The Pennsylvania Railroad, Philadelphia Improvements, Fox Building, Philadelphia, Pennsylvania.
- NUTTING, P. G.**, Director of Research, 1644 Irving Street, Washington, D. C.
- OAKLEAF, JAMES FRANCIS**, Chief of Research Laboratories, Vacuum Oil Company, Paulsboro, New Jersey.
- OATLEY, H. B.**, Chief Engineer, Locomotive Superheater Company, 33 Arleigh Road, Kensington, Great Neck, Long Island, New York.
- OBERLE, Dr. ALFRED**, Research Chemist, 500 Keith and Perry Building, Kansas City, Missouri.
- OBERLY, ALBERT D.**, Civil Engineer, Scottsdale, Pennsylvania.
- OERLEIN, KARL F.**, 2943 Cambridge Street, Philadelphia, Pennsylvania.
- OETTING, O. W. A.**, Electrical Engineer, Willard Battery Company, Cleveland, Ohio.
- OHMER, WILL I.**, President, Recording and Computing Machines Company, Dayton, Ohio.
- OLSEN, THORSTEN Y.**, Vice-President and Treasurer, Tinius Olsen Testing Machine Company, 500 North 12th Street, Philadelphia, Pennsylvania.
- OLSEN, TINIUS**, Mechanical Engineer, 500 North 12th Street, Philadelphia, Pennsylvania.
- OLSEN, WILLIAM AUSTIN**, Assistant, Physical Research Laboratory, Victor Talking Machine Company, and for mail, 812 North 8th Street, Camden, New Jersey.
- ORROK, GEORGE A.**, Consulting Engineer, 124 East 15th Street, New York City, New York.
- ORTENBLAD, RODOLPHO**, Electrical Engineer, Rua de Baependy, 62, Rio de Janeiro, Brazil.
- OSBOURNE, L. A.**, Vice-President, Westinghouse Electric and Manufacturing Company, 150 Broadway, New York City, New York.
- OTIS, SPENCER**, Manufacturer, Railway Exchange Building, Chicago, Illinois.
- OUTERBRIDGE, ALEXANDER E., Jr.**, Metallurgist, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- OWEN, BARTRAM ASHMEAD**, Civil Engineer, 802 Weightman Building, 1524 Chestnut Street, Philadelphia, Pennsylvania.
- PALMER, Dr. FREDERIC, Jr.**, Professor of Physics, Haverford College, Haverford, Pennsylvania.
- PALMER, T. CHALKLEY**, Second Vice-President, American Dyewood Company, and for mail, Chester, Pennsylvania.
- PALMER, WALTER**, Engineer, American Dyewood Company, and for mail, 105 West 23rd Street, Chester, Pennsylvania.
- PARISH, Le GRAND**, President, American Arch Company, Incorporated, and for mail, Mountain View, New Jersey.
- PARKER, EDWARD W.**, Statistician and Economist, 437 Chestnut Street, Philadelphia, Pennsylvania.
- PARKER, HENRY COLE**, Research Department, Leeds and Northrup Company, 4901 Stentor Avenue, Philadelphia, Pennsylvania.
- PARKER, JOHN C.**, in care of Lefax, Inc., Sheridan Building, Philadelphia, Pennsylvania.
- PARKIN, CHARLES H.**, Vice-President, The Vortex Manufacturing Company, 1978 West 77th Street, Cleveland, Ohio.
- PARR, S. W.**, Professor of Applied Chemistry, 107 Chemistry Building, Urbana, Illinois.
- PARRISH, THADDEUS ROWLAND**, Standardization Engineer, U. S. Gypsum Company, Chicago, Illinois, and for mail, 236 South Oak Park Avenue, Oak Park, Illinois.
- PARSONS, Sir CHARLES A.**, K.C.B., 6 Windsor Terrace, Newcastle-on-Tyne, England.
- PARSONS, Dr. LOUIS ALEXANDER**, Professor of Physics, 394 First Street, Walla Walla, Washington.
- PATTERSON, EDWARD B.**, Technical Editor, 121 East Rogers Avenue, Merchantville, New Jersey.
- PATTERSON, FRANCIS D.**, Physician, Chief of Division of Industrial Hygiene and Engineering, Department of Labor and Industry, Harrisburg, and for mail, 3500 Grays Ferry Road, Philadelphia, Pennsylvania.
- PATTERSON, J. EDWARD**, Vice-President, Arthur H. Thomas Company, 230 South 7th Street, Philadelphia, Pennsylvania.
- PATTON, O. M.**, Bell Telephone Company of Pennsylvania, 1835 Arch Street, Philadelphia, Pennsylvania.
- PAUL, H. N.**, Attorney-at-Law, 1815 Land Title Building, Philadelphia, Pennsylvania.
- PEARSON, FREDERICK J.**, 25 East Washington Street, Chicago, Illinois.
- PEARSON, JOSHUA A.**, Purchasing Agent, The United Gas Improvement Company, 1401 Arch Street, Philadelphia, Pennsylvania.
- PEASE, F. N.**, Chief Chemist, Pennsylvania Railroad Company, P. O. Box 503, Altoona, Pennsylvania.
- PEASE, FRANCIS G.**, Astronomical Engineer, Mount Wilson Solar Observatory, Pasadena, California.
- PECK, G. L.**, Vice-President, Personnel Department, Pennsylvania System, Broad Street Station, Philadelphia, Pennsylvania.
- PECK, STAUNTON B.**, Engineer and Manufacturer, Link-Belt Company, and for mail, Montgomery Avenue, Chestnut Hill, Philadelphia, Pennsylvania.

- PECKER, JOSEPH S.**, Mechanical Engineer, 706 Chestnut Street, and for mail, 5015 Boudinot Street, Philadelphia, Pennsylvania.
- PEEK, FRANK WILLIAM, Jr.**, Consulting and Research Electrical Engineer, General Electric Company, Pittsfield, Massachusetts.
- PEMBERTON, Dr. RALPH**, Physician, 2120 Sansom Street, and for mail, 2122 Sansom Street, Philadelphia, Pennsylvania.
- PENDER, HAROLD**, Professor of Electrical Engineering, Dean, Moore School of Electrical Engineering, University of Pennsylvania, Philadelphia, Pennsylvania.
- PENNOCK, GEORGE L.**, 165 West Essex Avenue, Lansdowne, Pennsylvania.
- PENROSE, CHARLES**, Electrical Engineer, in care of Day and Zimmermann, 1600 Walnut Street, Philadelphia, Pennsylvania.
- PENROSE, R. A. F., Jr.**, Geologist, 460 Bullitt Building, Philadelphia, Pennsylvania.
- PEPPER, DAVID**, Engineer, Commonwealth Building, Philadelphia, Pennsylvania.
- PERKINS, GEORGE WESLEY**, Instructor in Chemistry, Union Avenue, Delanco, New Jersey.
- PEROT, T. MORRIS, Jr.**, Malt Manufacturer, 605 Chestnut Street, Philadelphia, Pennsylvania.
- PERROT, EMILE G.**, Architect and Engineer, Boyertown Building, 1211 Arch Street, Philadelphia, Pennsylvania.
- PERRY, ROBERT S.**, President, Franklin H. Kalbfleisch Company, 31 Union Square, West, New York City, New York.
- PERSHING, General JOHN J.**, War Department, Washington, D. C.
- PETERSON, WALTER**, 80 Federal Street, Boston, Massachusetts.
- PEW, J. HOWARD**, President, Sun Oil Company, and Sun Shipbuilding Company, Finance Building, Philadelphia, Pennsylvania.
- PHILIPS, EDWIN S.**, President, Philbrin Corporation, Kennett Square, Pennsylvania.
- PICOLET, LUCIEN E.**, Mechanical Engineer, 116 North 34th Street, Philadelphia, Pennsylvania.
- PIERCE, G. A.**, Electrical Engineer, Wm. Cramp and Sons Ship and Engine Building Company, Philadelphia, Pennsylvania.
- PILLMORE, Dr. GEORGE, UTLEY**, Physician, Bryn Mawr Hospital, Bryn Mawr, Pennsylvania.
- PITMAN, Brigadier-General JOHN** (Retired), 611 Berkeley Avenue, Orange, New Jersey.
- PLACE, SAMUEL**, 622 Stanbridge Street, Norristown, Pennsylvania.
- PLACK, W. L.**, Architect and Structural Engineer, Southwest Corner 12th and Locust Streets, Philadelphia, Pennsylvania.
- PLASS, WILLIAM**, Salesman, 821 Arch Street, and for mail, 2103 North 18th Street, Philadelphia, Pennsylvania.
- PLATT, H. H.**, Mechanical Engineer, Wallingford, Pennsylvania.
- POND, Dr. SAMUEL ERNEST**, Assistant Professor of Physiology, School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania.
- POOLE, ARTHUR F.**, Engineer, Morse Chain Company, Ithaca, New York.
- POPE, FREDERICK**, Consulting Engineer, 60 Broadway, New York City, New York.
- POPE, RALPH W.**, Honorary Secretary, American Institute of Electrical Engineers, and for mail, 16 Castle Hill Avenue, Great Barrington, Massachusetts.
- PORTER, HARRY F.**, Ajax Electrothermic Corporation, Trenton, New Jersey.
- PORTER, Dr. HORACE C.**, Consulting Chemist and Chemical Engineer, 1833 Chestnut Street, Philadelphia, Pennsylvania.
- PORTER, J. BENTON**, Electrical Engineer, 1527 Spruce Street, Philadelphia, Pennsylvania.
- PORTER, ROLAND G.**, Gas Engineer, Swarthmore, Pennsylvania.
- POSER, Dr. M.**, 16 Vick Park B, Rochester, New York.
- POSTLES, JOHN van GASKEN**, Assistant to Chief Engineer, Philadelphia Gas Works, 1401 Arch Street, Philadelphia, Pennsylvania.
- POSTLETHWAITE, C. E.**, General Sales Manager, Pressed Steel Car Company, 55 Broad Street, New York City, New York.
- POTTER, ROWLAND S.**, Defender Photo Supply Company, Rochester, New York.
- POTTS, JOSHUA R. H.**, Attorney-at-Law, 929 Chestnut Street, Philadelphia, Pennsylvania.
- POTTS, WILLIAM M.**, Civil Engineer, Wyebrooke, Chester County, Pennsylvania.
- POWER, ARCHIE DAYTON**, Physicist, Department of Physics, Lawrence College, Appleton, Wisconsin.
- PRATT, CARL D.**, Chemist, 412 West Broad Street, Tamaqua, Pennsylvania.
- PRESSELL, GEORGE W.**, Chief Chemist, 240 West Somerset Street, Philadelphia, Pennsylvania.
- PRICE, MAX CHARLES**, Architect, Punta Gorda, Florida.
- PRICE, MORTON MOORE**, Sales Agent, The Babcock and Wilcox Company, 1120 Packard Building, Philadelphia, Pennsylvania.
- PURCELL, JOHN**, Assistant to Vice-President, Atchison, Topeka and Santa Fe Railway Company, 80 East Jackson Boulevard, Chicago, Illinois.
- QUIMBY, HENRY H.**, Consulting Structural Engineer, 4951 Pine Street, Philadelphia, Pennsylvania.
- QUINN, C. H.**, Electrical Engineer, Room 420, Pacific Mutual Building, 660 Market Street, San Francisco, California.
- RAFF, ALBERT RAYMOND**, Builder, 1631-1635 Thompson Street, Philadelphia, Pennsylvania.
- and for mail, 1300 Oak Lane Avenue, Philadelphia, Pennsylvania.
- RAMBO, S. MILTON**, Student, 406 Linden Street, Camden, New Jersey.
- RAMSBURG, C. J.**, Vice-President, The Koppers Company, Pittsburgh, Pennsylvania.
- RAMSEY, GEORGE W.**, Patent Attorney, Woolworth Building, New York City, New York.
- RANDALL, HENRY LeROY**, President, Riverside Metal Company, Riverside, New Jersey.
- RANDOLPH, ALFRED MAGILL**, Electrical Engineer, Post Office box, 489, Warrenton, Virginia.
- RANGER, RICHARD H.**, Radio Engineer, 66 Broad Street, New York City, New York.

- RANKEN, HAROLD**, Chief Engineer, Leeds and Northrup Company, and for mail, 5046, Erringer Place, Germantown, Philadelphia, Pennsylvania.
- RAPP, I. M.**, Physicist, R. D. 3, Phoenixville, Pennsylvania.
- RAU, ALBERT GEORGE**, Professor of Mathematics and Dean, Moravian College and Theological Seminary, Bethlehem, Pennsylvania.
- RAUTENSTRAUCH, WALTER**, Vice-President and General Manager, Liberty Yeast Corporation, 2 West 46th Street, New York City, New York.
- RAYMOND, WARD**, Mechanical Engineer, 908 Paxinosa Avenue, Easton, Pennsylvania.
- REA, SAMUEL**, Retired President, Pennsylvania Railroad Company, Room 215, Broad Street Station, Philadelphia, Pennsylvania.
- REATH, THEODORE W.**, Attorney-at-Law, 1201 Commercial Trust Building, Philadelphia, Pennsylvania.
- REBER, Colonel SAMUEL**, Director, Radio Corporation of America, 66 Broad Street, New York City, New York.
- REBMANN, G. R.**, Vice-President, Otis Elevator Company, 16th and Sansom Streets, Philadelphia, Pennsylvania.
- RECTOR, THOMAS M.**, 5 Courier Street, Rutherford, New Jersey.
- REDDING, CHARLES S.**, Treasurer, Leeds and Northrup Company* and for mail, 240 Wyncote Road, Jenkintown, Pennsylvania.
- REDFIELD, ROBERT S.**, Wayne, Pennsylvania.
- REESE, CHARLES L.**, Chemical Engineer, E. I. du Pont de Nemours and Company, Wilmington, Delaware.
- REICHARDT, HENRY** (Retired), 3581 Queen Lane, East Falls, Philadelphia, Pennsylvania.
- REILLY, HERSHELL EDWARD**, Professor of Physics, McGill University, Montreal, P. Q., Canada.
- REILLY, MARION**, 2015 DeLancey Place, Philadelphia, Pennsylvania.
- RENO, JESSE W.**, Consulting Engineer, 1158 Fifth Avenue, New York City, New York.
- REOCH, ALEXANDER ERNEST**, Electrical Engineer, The Radio Corporation of America, 233 Broadway, New York City, New York.
- RESINES, JAVIER**, Industrial Chemist, Racquet Club, Philadelphia, Pennsylvania.
- RHOADS, J. J.**, Superintendent, Pennsylvania Railroad Company, and for mail, Miller Park, Franklin, Pennsylvania.
- RICE, CHARLES D.**, Manager of Factory, Underwood Typewriter Company, 581 Capitol Avenue, Hartford, Connecticut.
- RICE, E. W., Jr.**, Electrical Engineer, Chairman of the Board, General Electric Company, Schenectady, New York.
- RICHARDS, CHARLES RUSS**, President, Lehigh University, Bethlehem, Pennsylvania.
- RICHARDS, HORACE CLARK**, Professor of Mathematical Physics, University of Pennsylvania, and for mail, 4812 Fairmount Avenue, Philadelphia, Pennsylvania.
- RICHARDS, JOHN**, Address unknown.
- RICHARDS, THEODORE WM.**, Director, Wolcott Gibbs Memorial Laboratory, Harvard University, Cambridge, Massachusetts.
- RICHARDSON, CHARLES E.**, Engineer, in care of The Yale Club, 44th Street and Vanderbilt Avenue, New York City, New York.
- RICHARDSON, WILLIAM E.**, Radio Mechanic, 5449 Locust Street, Philadelphia, Pennsylvania.
- RICKERSBERG, SIDNEY BRADLEY**, Mechanical Engineer, Leeds and Northrup Company, and for mail, 345 Hicks Street, Germantown, Philadelphia, Pennsylvania.
- RICKETTS, L. D.**, Mining Engineer, 325 Pacific Southwest Bank Building, Pasadena, California.
- RIDGWAY, ELLIS B.**, Manufacturer, 367 West Main Street, Coatesville, Pennsylvania.
- RIDGWAY, ROBERT**, Chief Engineer, Board of Transportation, 49 Lafayette Street, New York City, New York.
- RIDGWAY, WILLIAM H.**, Civil Engineer and Manufacturer, The Craig Ridgway and Son Company, Coatesville, Pennsylvania.
- RIEHLE, FREDERICK A.**, President, Riehle Brothers Testing Machine Company, 1424 North 9th Street, Philadelphia, Pennsylvania.
- RIGLING, ALFRED**, Librarian, The Franklin Institute, and for mail, 4835 Haverford Avenue, Philadelphia, Pennsylvania.
- RINGWALT, ROLAND**, Clergyman, 3016 Carman Street, Camden, New Jersey.
- RITCHIE, KENNETH MONTGOMERY**, Chemist, Armstrong Cork Company, Gloucester, New Jersey.
- RITTER, LOUIS E.**, Consulting Civil Engineer, 1707 Marquette Building, Chicago, Illinois.
- RITTMAN, Dr. W. F.**, Chemical Engineer, Carnegie Institute of Technology, Pittsburgh, Pennsylvania.
- ROBB, RUSSELL**, Senior Vice-President, Stone and Webster, Incorporated, 147 Milk Street, Boston, Massachusetts.
- ROBERTS, CHARLES C.**, Chemist, Arthur H. Thomas Company, Philadelphia, and for mail 75 West La Crosse Avenue, Lansdowne, Pennsylvania.
- ROBERTSON, SYDNEY C.**, Engineering Draughtsman, "Clifton" Kirribilli Pt. Sydney, N. S. W., Australia.
- ROBINSON, ANTHONY W.**, Insurance, 6 College Avenue, Haverford, Pennsylvania.
- ROBINSON, DWIGHT P.**, Consulting Engineer, Stuyvesant Avenue, Milton Point, Rye, New York.
- ROBINSON, EDMUND G.**, Chemist, 909 Nottingham Road, Wilmington, Delaware.
- ROBINSON, WILLIAM WILSON**, Ship and Yacht Builder, Camden, New Jersey, and for mail, 6446 Sherwood Road, Overbrook, Pennsylvania.
- RODMAN, HUGH**, Engineer and Manufacturer, in care of Rodman Chemical Company, Verona, Pennsylvania.

- RODMAN, Dr. JESSIE A.**, Teacher of Physics, 81 High Street, Germantown, Philadelphia.
- ROGERS, FRANK D.**, 1702 West Erie Avenue, Philadelphia, Pennsylvania.
- ROGERS, FRANK H.**, Mechanical Engineer, William Cramp and Sons Ship and Engine Building Company, Philadelphia, Pennsylvania.
- ROGERS, JAMES S.**, Attorney-at-Law, 701 Commonwealth Trust Building, Philadelphia, Pennsylvania.
- ROGERS, TALBOT MERCER**, Student, 7 E. M. Witherspoon Hall, Princeton University, Princeton, New Jersey.
- ROLLE, SYLVAN D.**, Electrical Designer, The Philadelphia Electric Company, and for mail, 1541 North Gratz Street, Philadelphia, Pennsylvania.
- ROLLER, FRANK W.**, Electrical and Mechanical Engineer, 233 Broadway, New York City, New York.
- RONDINELLA, L. F.**, Head of Drawing and Designing, West Philadelphia High School for Boys, 48th and Walnut Streets, Philadelphia, Pennsylvania.
- ROONEY, FREDERICK M.**, The Emil Greiner Company, 55 Fulton Street, New York City, New York.
- ROOSEVELT, NICHOLAS G.**, Vice-President, Day and Zimmermann, Inc., Engineers, 1600 Walnut Street, Philadelphia, Pennsylvania.
- ROSENBAUM, MORRIS**, Foreign Exchange, 605 South 3rd Street, Philadelphia, Pennsylvania.
- ROSENBAUM, W. A.**, Patent Attorney, 41 Park Row, New York City, New York.
- ROSENCRANS, CRANDALL Z.**, Research Engineer, Leeds and Northrup Company, 4901 Stenton Avenue, Philadelphia, Pennsylvania.
- ROSENGARTEN, FREDERIC**, Manufacturing Chemist, P. O. Box 1625, Philadelphia, Pennsylvania.
- ROSENGARTEN, Dr. GEORGE D.**, Manufacturing Chemist, P. O. Box 1625, Philadelphia, Pennsylvania.
- ROSIN, JOSEPH**, Chemist, Powers-Weightman-Rosengarten Company, 9th and Parrish Streets, Philadelphia, Pennsylvania.
- ROSS, HOWARD**, Bell Telephone Company of Pennsylvania, 1835 Arch Street, Philadelphia, Pennsylvania.
- ROSS, RAYMOND W.**, Designer, Leeds and Northrup Company, and for mail, 4727 A Street, Philadelphia, Pennsylvania.
- ROSS, T. EDWARD**, Certified Public Accountant, 1209 Morris Building, Philadelphia, Pennsylvania.
- ROTHERMEL, JOHN JACOB**, Teacher of Physics, Eastern High School, and for mail, 3126 Woodley Road, N.W., Washington, D.C.
- ROULTON, JOHN A.**, Rainey-Wood Coke Company, Swedeland, Pennsylvania, and for mail, Norris Apartments, Norristown, Pennsylvania.
- ROWLAND, THEODORE S.**, Head of Science Department, Northeast High School, and for mail, 6311 North Camac Street, Philadelphia, Pennsylvania.
- RUGG, W. S.**, The University Club, Natalie Street, Pittsburgh, Pennsylvania.
- RUMBROUGH, JOHN B.**, Consulting Mechanical Engineer, P. O. Box 2, Asheville, North Carolina.
- RUSBY, J. M.**, Engineer of Tests, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- RUSHMORE, DAVID B.**, Consulting Electrical Engineer, University Club, 1 West 54th Street, New York City, New York.
- RUSSELL, CHARLES J.**, Manager, Sales Department, The Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Pennsylvania.
- RUST, HENRY P.**, Civil Engineer, Manager of Harper and Taylor, Room 1411, 225 South 15th Street, Philadelphia, Pennsylvania.
- RUTHERFORD, Sir ERNEST**, Cavendish Professor of Experimental Physics, The University of Cambridge, Cambridge, England.
- SABINE, PAUL E.**, Physicist, Riverbank Laboratories, Geneva, Illinois.
- SADTLER, SAMUEL S.**, Consulting Chemist, 210 South 13th Street, Philadelphia, Pennsylvania.
- SAFFORD, Dr. FREDERICK HOLLISTER**, Professor of Mathematics, College Hall, University of Pennsylvania, Philadelphia, Pennsylvania.
- SAGEBEER, RICHARD G.**, Professor of Physics and Chemistry, Swarthmore Preparatory School, P. O. Box 34, Swarthmore, Pennsylvania.
- SAILER, RANDOLPH**, Attorney-at-law, 920 Commercial Trust Building, and for mail, 441 Carpenter Lane, Germantown, Philadelphia, Pennsylvania.
- SALMON, FREDERICK W.**, Civil and Mechanical Engineer, P. O. Box 1104, Birmingham, Alabama.
- SALOM, PEDRO G.**, Electro-Chemical Engineer, Commonwealth Trust Building, Philadelphia, Pennsylvania.
- SAMUEL, J. BUNFORD**, Retired Iron Merchant, 1609 Spruce Street, Philadelphia, Pennsylvania.
- SANBORN, EDWARD H.**, Coal Mining, 1100 Commercial Trust Building, Philadelphia, Pennsylvania.
- SANDERSON, R. P. C.**, The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania, and for mail, Moylan, Pennsylvania.
- SANDS, BENJAMIN WILEY**, Research Worker, 1307 "N" Street, N. W., Washington, D.C.
- SANFORD, RUFUS H.**, Librarian, The Baldwin Locomotive Works, Philadelphia, Pennsylvania.
- SARGENT, CHARLES E.**, Research Engineer, 225 South 18th Street, Allentown, Pennsylvania.
- SARGENT, HENRY B.**, Hardware Manufacturer, 247 Church Street, New Haven, Connecticut.
- SARTAIN, PAUL J.**, Physician, 2006 Walnut Street, Philadelphia, Pennsylvania.
- SATTERTHWAITE, GEORGE**, Manufacturer of Steel, in care of Henry Disston and Sons, Tacony, Philadelphia, Pennsylvania.
- SAUER, FRANK H.**, Draftsman, 1307 Atlantic Avenue, Camden, New Jersey.

- SAUNDERS, LEWIS E., Manager of Research Laboratory, Norton Company, and for mail, 262 Salisbury Street, Worcester, Massachusetts.
- SAUNDERS, WALTER M., Analytical and Consulting Chemist, 20 Dewey Street, Olneyville, Providence, Rhode Island.
- SAUNDERS, WILLIAM E., Librarian, U. G. I. Building, Broad and Arch Streets, Philadelphia, Pennsylvania.
- SAVAGE, HARLOW DOW, Engineer, Scarsdale, New York.
- SAWTELLE, WILLIAM OTIS, Haverford, Pennsylvania.
- SCANNELL, GERALD EDWARD, Experimental Machinist, 3123 Tulip Street, Philadelphia, Pennsylvania.
- SCHEHL, OSCAR L., Mechanical Engineer, 1631 Girard Avenue, Philadelphia, Pennsylvania.
- SCHLACKS, CHARLES H., President, Keystone Watch Case Company, Riverside, New Jersey, and for mail, Bryn Mawr, Pennsylvania.
- SCHLAFGE, WILLIAM S., General Mechanical Superintendent, Erie Railroad Company, 50 Church Street, New York City, New York.
- SCHROM, OSCAR G., Mechanical Engineer, 6017 Nassau Street, Philadelphia, Pennsylvania.
- SCHWANK, JAMES L., 5760 North Marshall Street, Philadelphia, Pennsylvania.
- SCOTT, WM. M., Draftsman, Box 76, Radnor, Pennsylvania.
- SCULL, CHESTER, Jr., 2745 North 23rd Street, Philadelphia, Pennsylvania.
- SEELY, LESLIE B., Teacher, 5918 Pulaski Avenue, Germantown, Philadelphia, Pennsylvania.
- SELGA, M., Meteorologist and Astronomer, Manila Observatory, Manila, Philippine Islands.
- SELLERS, ALEXANDER, Manufacturer, 1600 Hamilton Street, Philadelphia, Pennsylvania.
- SELLERS, COLEMAN, 3rd, Mechanical Engineer, Wm. Sellers and Company, Inc., 1600 Hamilton Street, Philadelphia, Pennsylvania.
- SELLERS, HORACE W., Architect, Ardmore, Pennsylvania.
- SELLERS, HOWARD, Millbourne House, Millbourne, Pennsylvania.
- SELLERS, RICHARD, Bellevue, Delaware.
- SELLERS, RICHARD C., Civil Engineer, Swarthmore, Pennsylvania.
- SELLERS, Mrs. WILLIAM, Bellevue, Delaware.
- SELLERS, WILLIAM F., Manufacturer of Water Tube Boilers, Edge Moor, Delaware.
- SENER, RALPH TOWNSEND, Vice-President, Engineering, Mitten Management, Inc., 1520 Spruce Street, Philadelphia, Pennsylvania.
- SEVERY, MELVIN L., Inventor and Author, 431 South Berendo Street, Los Angeles, California.
- SHACKELFORD, BENJAMIN E., Physicist, Westinghouse Lamp Company, Bloomfield, New Jersey.
- SHAND, A. C., Civil Engineer, Merion, Pennsylvania.
- SHARP, Dr. CLAYTON H., Technical Director, Electrical Testing Laboratories, 80th Street and East End Avenue, New York City, New York.
- SHARP, Dr. HARRY M., Physicist, Normal College, Natchitoches, Louisiana.
- SHARPE, Dr. JOHN S., Physician, Haverford, Pennsylvania.
- SHATTUCK, A. F., Chief Chemist, Solvay Process Company, and for mail, 614 North Canon Drive, Beverly Hills, California.
- SHATTUCK, JOHN D., Gas Engineer, Chester, Pennsylvania.
- SHAW, A. NORMAN, Associate Professor of Physics, McGill University, Montreal, Canada.
- SHAW, DEXTER NICHOLS, Chemical Engineer, 32 South Broad Street, Philadelphia, Pennsylvania.
- SHIMER, PORTER W., Chemist and Metallurgist, Easton, Pennsylvania.
- SHMIDHEISER, W. A., Mechanical Engineer, The Bell Telephone Company of Pennsylvania, and for mail, 6017 Pine Street, Philadelphia, Pennsylvania.
- SHOBER, SAMUEL L., Special Representative, Union Switch and Signal Company, and for mail, Rittenhouse Club, 1811 Walnut Street, Philadelphia, Pennsylvania.
- SHOEMAKER, SAMUEL, Builder and Real Estate, 1214-1215 Franklin Trust Building, 1500 Chestnut Street, Philadelphia, Pennsylvania.
- SHOEMAKER, THOMAS H. (Retired), 120 West Tulpehocken Street, Germantown, Philadelphia, Pennsylvania.
- SHRADER, J. E., Professor of Physics, Drexel Institute, Philadelphia, Pennsylvania.
- SHUMAN, F. R., The Bell Telephone Company of Pennsylvania, 1631 Arch Street, Philadelphia, Pennsylvania.
- SHUMWAY, EDWARD, Merion, Pennsylvania.
- SIESLER, GEORGE J., Sales Engineer, Haverford, Pennsylvania.
- SILLCOX, LEWIS K., Mechanical and Electrical Engineer, Herrick Road, Box 579, Riverside, Illinois.
- SILVA, A. D., 346 Burns Street, Forest Hills, Long Island, New York.
- SIMS, Rear-Admiral WILLIAM S., U. S. N., 13 Catherine Street, Newport, Rhode Island.
- SIMSOHN, JULIAN STERN, Chemist, Southeast corner Broad Street and Girard Avenue, Philadelphia, Pennsylvania.
- SINKLER, JOHN P. B., Architect, 412 Otis Building, 112 South 16th Street, Philadelphia, Pennsylvania.
- SKLAR, SAMUEL BARTON, Chemical, Mechanical and Electrical Inventor, 1843 Ontario Place, Washington, D. C.
- SKINNER, C. E., Engineer, Research Division, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania.
- SKINNER, H. J., President, Skinner, Sherman and Esslen, Incorporated, Industrial Chemists, 276 Stuart Street, Boston, Massachusetts, and for mail, 42 Park Avenue, Wakefield, Massachusetts.
- SKINNER, ORVILLE CAMPBELL, Metallurgical Engineer, Superintendent, Standard Steel Works, Burnham, Pennsylvania.
- SLOATMAN, W. S., Supervisor, The Reading Company, Mahanoy Plane, Pennsylvania.
- SMALLING, ELMER, Jr., Student, 2939 North Camac Street, Philadelphia, Pennsylvania.

- SMITH, A. DW.**, Mining Engineer, 1732 Commercial Trust Building, Philadelphia, Pennsylvania.
- SMITH, ALBERT W.**, Professor of Industrial Chemistry, Case School of Applied Science, and for mail, 11333 Bellflower Road, Cleveland, Ohio.
- SMITH, A. T.**, in care of The Permutit Company, 440 Fourth Avenue, New York City, New York.
- SMITH, AUGUSTUS**, Civil Engineer, Elizabeth, R. F. D. No. 2, New Jersey.
- SMITH, EDWARD W.**, Chemical Engineer, 535 Church Lane, Germantown, Philadelphia, Pennsylvania.
- SMITH, ELMER, A.**, Consulting Electrical Engineer, 1281 Paterson Plank Road, Secaucus, New Jersey.
- SMITH, FRANK W.**, Vice-President and General Manager, The United Electric Light and Power Company, 130 East 15th Street, New York City, New York.
- SMITH, GEORGE W., Jr.**, Technical Assistant to Vice-President and General Manager, White Motor Company, Cleveland, Ohio.
- SMITH, HASELTINE**, Insurance Broker, 326 Walnut Street, Philadelphia, Pennsylvania.
- SMITH, HERBERT S. S.**, Professor of Civil Engineering, 205 Wallace Street, Stroudsburg, Pennsylvania.
- SMITH, IOWA**, Commercial Engineer, International Telephone Company, Clinton Building, Columbus, Ohio.
- SMITH, IRVING B.**, Chief of Research Department, Leeds and Northrup Company, and for mail, Ambler, Pennsylvania.
- SMITH, J. WALDO**, Consulting Engineer, Board of Water Supply, City of New York, Municipal Building, New York City, New York.
- SMITH, P. F., Jr.**, Paoli, Chester County, Pennsylvania.
- SMITH, S. D.**, Machinist, 1616 North Redfield Street, Philadelphia, Pennsylvania.
- SMITH, WALTER B.**, Builder, 6490 Woodbine Avenue, Overbrook, Philadelphia, Pennsylvania.
- SMITH, WILBUR ANDERSON**, Student, 808 Station Avenue, Haddon Heights, New Jersey.
- SMITH, W. HINCKLE**, Banker, Bryn Mawr, Pennsylvania.
- SMITH, W. LEIGH**, Chemist, The Viscose Company, Box 171, Marcus Hook, Pennsylvania.
- SNARE, FREDERICK**, Contracting Engineer, 114 Liberty Street, New York City, New York.
- SNELLING, WALTER O.**, Research Chemist, 110 South 13th Street, Allentown, Pennsylvania.
- SNOOK, H. CLYDE**, Electrical Engineer, care of Western Electric Company, 463 West Street, New York City, New York.
- SNYDER, CLINTON F.**, Chemist, Minersville, Pennsylvania.
- SNYDER, Professor MONROE B.**, Teacher and Astronomer, 120 Woodside Avenue, Narberth, Pennsylvania.
- SOUTHALL, JAMES P. C.**, Professor of Physics, Columbia University, New York City, New York.
- SPACKMAN**, Lieutenant-Colonel H. S., 105 Ardmore Avenue, Ardmore, Pennsylvania.
- SPENCER, H. B.**, 2012 Massachusetts Avenue, N. W., Washington, D. C.
- SPENCER, PAUL**, Electrical Engineer, The United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- SPENCER, THOMAS**, Engineer, 3523 Balsam Avenue, Indianapolis, Indiana.
- SPERR, F. W., Jr.**, Chief Chemist, The H. Koppers Company, Mellon Institute, Pittsburgh, Pennsylvania.
- SPERRY, ELMER A.**, Engineer, The Sperry Gyroscope Company, Sperry Building, Manhattan Bridge Plaza, Brooklyn, New York.
- SPICER, H. N.**, Metallurgical Engineer, The Architects Building, 247 Park Avenue, New York City, New York.
- SPITZ, SAMUEL**, Inventor, 730 Sun Finance Building, Los Angeles, California.
- SPITZGLASS, J. M.**, Mechanical Engineer, 2240 Diversey Boulevard, Chicago, Illinois.
- SPORN, PHILIP**, Electrical Engineer, American Gas and Electric Company, 30 Church Street, New York City, New York.
- SPRAGUE, FRANK J.**, Consulting Engineer, President, Sprague Safety Control and Signal Corporation, 421 Canal Street, New York City, New York.
- SPRONG, S. D.**, Electrical Engineer, Room 309, 25 Church Street, New York City, New York.
- SPROUL, Hon. WM. C.**, Manufacturer, 117 South Sixteenth Street, Philadelphia, Pennsylvania.
- SPRUANCE, W. C.**, Vice-President, E. I. du Pont de Nemours and Company, Room 9056, Dupont Building, Wilmington, Delaware.
- SQUIER, Major-General GEORGE OWEN**, K. C. M. G., D. S. C., War Department, Washington, D. C.
- ST. JOHN, ANCEL**, Consulting Physicist, Room 404, 505 Fifth Avenue, New York City, and for mail, 17 Hix Avenue, Rye, New York.
- STANFORD, Captain H. R.**, Civil Engineer (C. E. C.), U. S. N., Bureau of Yards and Docks, Navy Department, Washington, D. C.
- STANWICK, CHARLES A.**, Engineer, Day and Zimmermann, 1600 Walnut Street, Philadelphia, Pennsylvania.
- STEEL, JOSEPH M.**, Building Constructor, 1600 Arch Street, Philadelphia, Pennsylvania.
- STEINER, OSCAR**, Mechanician, Bartol Research Foundation of The Franklin Institute, 127 North 19th Street, Philadelphia, Pennsylvania, and for mail, 131 North 19th Street, Philadelphia, Pennsylvania.
- STEINMETZ, JOSEPH ALLISON**, Designer, Janney, Steinmetz and Company, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- STEBER, HENRY J.**, Chemist, 115 Beverly Road, Montclair, New Jersey.
- STEVENS, JOHN S.**, 9th Street and Montgomery Avenue, Philadelphia, Pennsylvania.

- STEVENSON, Dr. A. R. Jr., Electrical Engineer, General Electric Company, 1 River Road, Schenectady, New York.
- STEVENSON, S. PRICE, Manufacturer of Cold Storage Doors, 1500 West 4th Street, Chester, Pennsylvania.
- STEWART, A. V., Plant Department, The Bell Telephone Company of Pennsylvania, 1835 Arch Street, Philadelphia, Pennsylvania.
- STEWART, FRANK H., Dealer in Electrical Supplies, Old Mint Building, Philadelphia, Pennsylvania.
- STEWART, RALPH C., Attorney-at-Law, Sydenham Building, 1512 Walnut Street, Philadelphia, Pennsylvania.
- STEWART, THOMAS S., Physician, 1532 Pine Street, Philadelphia, Pennsylvania.
- STILLWELL, L. B., Consulting Engineer, 90 West Street, New York City, New York.
- STINE, WILBUR M., Author, 3932 Haverford Avenue, Philadelphia, Pennsylvania.
- STINSON, ROBERT, Chemist, 68 East Penn Street, Norristown, Pennsylvania.
- STOCKWELL, JOHN W., Pastor and Lecturer, Manager New Church Book Center, 2129 Chestnut Street, Philadelphia, Pennsylvania.
- STOERTZ, HOWARD, Research Chemist, Electric Storage Battery Company, and for mail, 430 West Durham Street, Mount Airy, Philadelphia, Pennsylvania.
- STOKES, FRANCIS J., Olney, Philadelphia, Pennsylvania.
- STOKLEY, JAMES, Staff writer, Science Service, B and 21st Streets, N. W., Washington, D. C.
- STONE, C. W., Electrical Engineer, General Electric Company, Schenectady, New York.
- STONE, JOHN STONE, Consulting Electrical Engineer, 3942 Alameda Street, San Diego, California.
- STOTESBURY, E. T., Banker, Chestnut and 5th Streets, Philadelphia, Pennsylvania.
- STOUGHTON, A. B., Attorney-at-Law, 1506 Land Title Building, Philadelphia, Pennsylvania.
- STOUT, ORIN C., Industrial Engineer, P. O. Box 865, Columbus, Ohio.
- STRADLING, Dr. G. F., Teacher, Principal, Northeast High School, and for mail, 5120 Newhall Street, Germantown, Philadelphia, Pennsylvania.
- STRONG, WILLIAM WALKER, Consulting Physicist, 500 South York Street, Mechanicsburg, Cumberland County, Pennsylvania.
- STROUD, EDWARD A., Florist, 508 South 41st Street, Philadelphia, Pennsylvania.
- STUTZ, ERNEST, Representative for Foreign Patents, 1705 Hope Street, South Pasadena, California.
- STYRI, Dr. HAAKON, Chief Chemist, S. H. F. Research Laboratory, Front Street and Erie Avenue, Philadelphia, Pennsylvania.
- SULZNER, CHARLES F., (Retired), San Sebastian Hotel, Coral Gables, Florida.
- SUMMERS, CLIFFORD JOHN, Nicollet, Minnesota.
- SUPPLEE, WM. H., Factory Manager, The S. S. White Dental Manufacturing Company, Unity and Oakland Streets, Frankford, Philadelphia, Pennsylvania.
- SUYDAM, V. A., Professor of Physics and Head of the Physics Department, Beloit College, and for mail, 1224 Porter Avenue, Beloit, Wisconsin.
- SWAAB, SOLOMON M., Civil Engineer, 210 City Hall, Philadelphia, Pennsylvania, and for mail, 1629 Diamond Street, Philadelphia, Pennsylvania.
- SWANN, WILLIAM FRANCIS GRAY, Professor of Physics, Sloane Laboratory, Yale University, New Haven, Connecticut.
- SWENSON, MAGNUS, President and Treasurer, Southern Wisconsin Power Company, Madison, Wisconsin.
- SYKES, JOHN P., The Baldwin Locomotive Works, Broad and Spring Garden Streets, Philadelphia, Pennsylvania.
- SYMONS, W. E., The Machinery Club, 50 Church Street, New York City, New York.
- SYNNESTVEDT, ARTHUR, 1015 Chestnut Street, Philadelphia, Pennsylvania.
- TABER, GEORGE H., Vice-President, Gulf Refining Company, P. O. Box 1214, Pittsburgh, Pennsylvania.
- TAGGART, WALTER T., Professor of Chemistry, University of Pennsylvania, Philadelphia, Pennsylvania.
- TAIT, EDWARD H., Virginville, Pennsylvania.
- TAIT, F. M., Callahan Bank Building, Dayton, Ohio.
- TALBOT, H. P., Professor of Inorganic Chemistry, Massachusetts Institute of Technology, Cambridge, Massachusetts.
- TANBERG, Dr. ARTHUR P., Chemist, E. I. du Pont de Nemours and Company, Henry Clay, Delaware.
- TATE, ALFRED O., President, Tate Electrolytic Textile Processes, Incorporated, 45 Sceptre House, 169-173 Regent Street, London, W. I, England.
- TATNALL, J. S., Traffic Department, The Bell Telephone Company of Pennsylvania, Eleventh Floor, 1835 Arch Street, Philadelphia, Pennsylvania.
- TATNALL, Dr. ROBERT R., Research Engineer, J. E. Rhoads and Sons, Wilmington, Delaware.
- TAYLOR, DAVID WATSON, Rear-Admiral, U. S. N., 1813 19th Street, N. W., Washington, D. C.
- TAYLOR, H. BIRCHARD, President, Harper and Taylor, Inc., Bankers Trust Building, Philadelphia, Pennsylvania.
- TAYLOR, HOLLINGSHEAD N., Tinplate Manufacturer, Liberty Trust Building, Northeast Corner Broad and Arch Streets, Philadelphia, Pennsylvania.
- TAYLOR, LOWNEDES, 2006 Shunk Street, Point Breeze, Philadelphia, Pennsylvania.
- TEEPLE, Dr. JOHN E., Consulting Chemist and Chemical Engineer, 50 East 41st Street, New York City, New York.
- TEMPLE, EDWARD B., Swarthmore, Pennsylvania.
- THOMAS, ARTHUR H., Laboratory Appliances, West Washington Square, Philadelphia, Pennsylvania.
- THOMAS, C. C., Professor of Mechanical Engineering, 310-311 Union Oil Building, 617 West Seventh Street, Los Angeles, California.
- THOMAS, L. E., President, Reading Iron Company, Reading, Pennsylvania.

- THOMPSON, ARTHUR W.**, President, United Gas Improvement Company, Broad and Arch Streets, Philadelphia, Pennsylvania.
- THOMPSON, HUGH L.**, Consulting Engineer, Waterbury, Connecticut.
- THOMPSON, PAUL**, Northwest corner Broad and Arch Streets, Philadelphia, Pennsylvania.
- THOMPSON, RUSSELL GRIFFITH**, Electrical and Mechanical Engineer, North East Electric Company, 373 Lyell Avenue, Rochester, New York.
- THOMSON, Professor ELIHU**, Electrical Engineer, 22 Monument Avenue, Swampscott, Massachusetts.
- THOMSON, FRANCIS DuPONT**, Engineer, 241 East Main Street, Elkton, Maryland.
- THOMSON, Sir JOSEPH J.**, Trinity College, Cambridge, England.
- THURLOW, WILLIAM HERMAN**, Electrical Engineer, 30 Müllerstr., Berlin N. 65, Germany.
- THWING, Dr. CHAS. BURTON**, 3339 Lancaster Avenue, Philadelphia, Pennsylvania.
- TIDDY, WILLIAM**, Chief Chemist, Rainey-Wood Coke Company, Swedeland, Pennsylvania.
- TIEMANN, HUGH P.**, Metallurgical Engineer, Carnegie Steel Company, Pittsburgh, Pennsylvania.
- TIKHONOVITCH, BENEDICT**, Electrical Engineer, The New York Edison Company, 130 East 15th Street, and for mail, 201 West 109th Street, New York City, New York.
- TILGHMAN, B. C.**, "The Hermitage" near Centreville, Queen Ann County, Maryland.
- TILY, HERBERT JAMES**, Merchant, Strawbridge and Clothier, Market and Eighth Streets, Philadelphia, Pennsylvania.
- TOCH, Dr. MAXIMILIAN**, Paint Manufacturer, Director, Research Laboratories, Toch Brothers, 443 Fourth Avenue, New York City, New York.
- TORCHIO, PHILIP**, Electrical Engineer, Vice-President, The New York Edison Company, 124 East 15th Street, New York City, New York.
- TOULMIN, H. A., Jr.**, Patent Attorney, 901 Schwind Building, Dayton, Ohio.
- TOWLE, HERBERT L.**, Technical Advertising, 4553 Adams Avenue, Frankford, Philadelphia, Pennsylvania.
- TOWNEND, R. V.**, Research Chemist, Department of Chemistry, University of Delaware, Newark, Delaware.
- TOWNSEND, JOHN SEALY**, Professor of Physics, New College, Oxford, England.
- TOWNSEND, J. W.**, 825 Montgomery Avenue, Bryn Mawr, Pennsylvania.
- TRAUTWINE, JOHN C., 3rd**, Civil Engineer, P. O. Box 26, Wallingford, Pennsylvania.
- TRENCH, W. W.**, The General Electric Company, Schenectady, New York.
- TREXLER, Colonel HARRY C.**, President, Lehigh Portland Cement Company, Allentown, Pennsylvania.
- TROWBRIDGE, Professor AUGUSTUS**, Teacher, Princeton University, Princeton, New Jersey.
- TRUE, RODNEY H.**, Professor of Botany, University of Pennsylvania, Philadelphia, Pennsylvania.
- TRUEMAN, WILLIAM H.**, Dentist, 47 High Street, Germantown, Philadelphia, Pennsylvania.
- TULL, CHARLES EDGAR**, Electrical Contractor, 1832 Ludlow Street, Philadelphia, Pennsylvania.
- TURNER, O. A.**, Address unknown.
- TUTTLE, E. B.**, Engineer of Transmission and Protection, The Bell Telephone Company, 1631 Arch Street, Philadelphia, Pennsylvania.
- TUTTLE, WM. C.**, Manager of Trust Investments, Girard Trust Company, Philadelphia, Pennsylvania.
- TUTWILER, C. C.**, Consulting Gas Chemist, West Conshohocken, Pennsylvania.
- TYLER, SYDNEY F.**, Land Title Building, Philadelphia, Pennsylvania.
- UEHLING, E. A.**, Mechanical Engineer, 1466 Fourth Street, Milwaukee, Wisconsin.
- ULMER, CARL D.**, Chemist, The Koppers Company Laboratories, Mellon Institute, Pittsburgh, Pennsylvania.
- UMSTEAD, C. H.**, Civil Engineer, General Delivery, Portsmouth, New Hampshire.
- UNDERWOOD, FREDERICK D.**, President, Erie Railroad Company, 50 Church Street, New York City, New York.
- UNWIN, WILLIAM CAWTHORNE**, Civil Engineer, Palace Gate Mansions, Kensington, London, England.
- VAIL, JAMES G.**, Chief Chemist, Philadelphia Quartz Company, 121 South 3rd Street, Philadelphia, Pennsylvania.
- VALENTINE, WARREN P.**, Mechanical Engineer, Haddonfield, New Jersey.
- VAN DER LINGEN, J. STEPHEN**, Lecturer, Erinville, Hilton Road, Seapoint, Cape Town, South Africa.
- VAN DEVENTER, CHRISTOPHER**, Consulting Engineer, 438 First National Bank Building, Chicago, Illinois.
- VAN DEVENTER, H. R.**, Engineer and Patent Attorney, Dubilier Condenser and Radio Corporation, 59 Washington Square, South, New York City, New York.
- VAN DYKE, J. W.**, President, The Atlantic Refining Company, and for mail, The Wellington, Philadelphia, Pennsylvania.
- VAN TRUMP, S. N.**, Civil Engineer, Water Department, Wilmington, Delaware.
- VAUCLAIN, S. M.**, President, The Baldwin Locomotive Works, 500 North Broad Street, Philadelphia, Pennsylvania.
- VAUGHAN, H. H.**, Engineer, 285 Beaver Hall Hill, Montreal, P. Q., Canada.
- VAUGHEN, F. G.**, Manager, Meter Department, General Electric Company, Schenectady, New York.
- VAUX, GEORGE, Jr.**, Attorney-at-Law, Gulf Road, Bryn Mawr, Pennsylvania.
- VEEDER, CURTIS H.**, Manufacturer, Veeder Manufacturing Company, Hartford, Connecticut.
- VOGDES, FRANCIS B.**, Research Worker, Research Laboratory, General Electric Company, Schenectady, New York, and for mail, 30 Irving Road, Scotia, New York.
- VOGDES, JOSEPH JOHNSON**, 310 Commercial Trust Building, Philadelphia, Pennsylvania.
- VOGLESON, JOHN A.**, Civil Engineer, 8009 Crefeldt Street, Philadelphia, Pennsylvania.

- VOGT, ALEXANDER CHARLES, Chemical Engineer, 255 Hicks Street, Brooklyn, New York.
- VOGT, CLARENCE CHARLES, Research Chemist, Armstrong Cork Company, Gloucester, New Jersey, and for mail, 408 Westmont Avenue, Haddonfield, New Jersey.
- VOLLRATH, ALFRED J., 158 Carpenter Lane, Mount Airy, Philadelphia, Pennsylvania.
- VREELAND, FREDERICK R., Research Engineer, 90 West Street, New York City, New York.
- WADDELL, J. A. L., Consulting Engineer, 150 Broadway, New York City, New York.
- WADLEIGH, FRANCIS R., 1 Broadway, New York City, New York.
- WADSWORTH, F. L. O., Consulting and Advisory Engineer, P. O. Box 268, East Liberty Station, Pittsburgh, Pennsylvania.
- WAGNER, FRED H., Chief Engineer, The Bartlett Hayward Company, and for mail, Tuscany Apartments, 39th Street and Stony Run Lane, Baltimore, Maryland.
- WAGNER, HERBERT A., President, Consolidated Gas, Electric Light and Power Company, Lexington and Liberty Streets, Baltimore, Maryland.
- WAGNER, JOHN, Merchant, "Four Oaks" School House Lane, Germantown, Philadelphia, Pennsylvania.
- WAGNER, SAMUEL T., Consulting Engineer, Reading Company, and for mail, School House Lane, Germantown, Philadelphia, Pennsylvania.
- WAGNER, WALTER C., Electrical Engineer, Philadelphia Electric Company, 2301 Market Street, Philadelphia, Pennsylvania.
- WAIDLICH, J. E., Bell Telephone Company of Pennsylvania, 1631 Arch Street, Philadelphia, Pennsylvania.
- WALDRON, WILLIAM H., Manufacturer of Machinery, John Waldron Company, New Brunswick, New Jersey.
- WALKER, J. W., Manufacturer, Devon, Pennsylvania.
- WALLER, ALFRED E., Electrical Engineer, Lawrence Park, Bronxville, New York.
- WALLERSTEIN, LEO, Chemist, 171 Madison Avenue, New York City, New York.
- WALLIS, J. T., Assistant Vice-President, Pennsylvania Railroad System, Broad Street Station, Philadelphia, Pennsylvania.
- WALTON, HORACE, Insurance, 416-420 Walnut Street, Philadelphia, Pennsylvania.
- WARDEN, WILLIAM G., 809 Witherspoon Building, Philadelphia, Pennsylvania.
- WARNER, WILLIAM R., Jr. (Retired), Union League, Broad and Sansom Streets, Philadelphia, Pennsylvania.
- WARNOCK, JAMES, Jr., Banker, 333 Chestnut Street, Philadelphia, Pennsylvania.
- WARRINER, S. D., President, Lehigh Coal and Navigation Company, 437 Chestnut Street, Philadelphia, Pennsylvania.
- WATSON, JAMES, Steam Specialty Manufacturer, 146 North 7th Street, Philadelphia, Pennsylvania.
- WEATHERWAX, JAMES LLOYD, Physicist, Philadelphia General Hospital, 34th and Pine Streets, and for mail, 932 North 65th Street, Philadelphia, Pennsylvania.
- WEBBER, GEORGE C., American Engineering Company, Philadelphia, Pennsylvania, and for mail, 4653 North Mervine Street, Philadelphia, Pennsylvania.
- WEBSTER, ALBERT L., Consulting Sanitary Engineer, 112 E. 40th Street, New York City, New York.
- WEBSTER, GEORGE S., Civil Engineer, 4900 Penn Street, Frankford, Philadelphia, Pennsylvania.
- WEBSTER, WM. R., Consulting and Inspecting Engineer, 3818 Chestnut Street, Philadelphia, Pennsylvania.
- WEEKS, EDWIN R., Consulting Engineer, 505 New Nelson Building, Kansas City, Missouri.
- WEIDLEIN, Dr. EDWARD R., Chemical Engineer, Director of Mellon Institute of Industrial Research, Pittsburgh, Pennsylvania.
- WEINBERG, SOLOMON, Chemical Engineer, Research Laboratory, 2027 Arch Street, and for mail, 1913 Arch Street, Philadelphia, Pennsylvania.
- WEISS, J. M., 50 East 41st Street, New York City, New York.
- WELLES, HOWARD W., Mechanical Engineer, John Warren Watson Company, 24th and Locust Streets, Philadelphia, Pennsylvania, and for mail, 224 West Fisher's Avenue, Olney, Philadelphia, Pennsylvania.
- WELLMAN, NOEL T., 21 Prospect Street, East Orange, New Jersey.
- WELLS, W. F., Vice-President, Edison Electric Illuminating Company, 360 Pearl Street, Brooklyn, New York.
- WELSH, FRANCIS RALSTON, Investments, Devon, Pennsylvania.
- WELTZ, EARL H., Chemist, 701 Packard Building, 15th and Chestnut Streets, Philadelphia, Pennsylvania.
- WENDT, Dr. GERALD, State College, Pennsylvania.
- WERTHEIM, FERD. ELIEL, Mechanical Designer, 8147 Kimbark Avenue, Chicago, Illinois.
- WESTON, Dr. EDWARD, President, Weston Electrical Instrument Company, Waverly Park, Newark, New Jersey.
- WESTON, F. W., Manufacturer, Wynnewood, Pennsylvania.
- WETHERILL, HENRY EMERSON, Physician, Scientist, Inventor, R. D. No. 1, Phoenixville, Pennsylvania.
- WETHERILL, ROBERT, Engine and Machine Work Manufacturer, Chester, Pennsylvania.
- WETHERILL, W. CHATTIN, Department of Mechanical Engineering, University of Pennsylvania, Philadelphia, Pennsylvania.
- WEYL, CHARLES N., 255 Harvey Street, Germantown, Philadelphia, Pennsylvania.
- WHARTON, HENRY, Chestnut Hill, Philadelphia, Pennsylvania.
- WHITAKER, JAMES L., Cotton Manufacturer, Cedar Grove, Olney, Philadelphia, Pennsylvania.
- WHITE, A. RAYMOND, Research Physicist, 3703 Berkley Drive, Toledo, Ohio.
- WHITE, J. ATWOOD, Paper Machinery Manufacturer, 15th Street and Lehigh Avenue, Philadelphia, Pennsylvania.

- WHITE, W. M.**, Hydraulic Engineer, Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin.
- WHITNEY, ASA W.**, Metallurgist, in care of Enterprise Foundry and Machine Works, Bristol, Tennessee.
- WHITNEY, CHARLES H.**, Whitney-MacDonald Company, 940 Edmonds Avenue, Upper Darby, Delaware County, Pennsylvania.
- WHITNEY, E. R.**, President, Commercial Truck Company, Hunting Park and Rising Sun Avenues, Philadelphia, Pennsylvania.
- WHITNEY, FRANK E.**, Mechanical Engineer, 6653 Lawnton Avenue, Oak Lane, Philadelphia, Pennsylvania.
- WHITNEY, LOUIS B.**, Manager, Alpha Portland Cement Company, 428 Oliver Building, Pittsburgh, Pennsylvania.
- WHYTE, F. M.**, 14 Benedict Avenue, Tarrytown, New York.
- WIDDICOMBE, Major R. A.**, Engineer, 1120 Lake Shore Drive, 3 B, Chicago, Illinois.
- WIDMYER, JOHN HENRY**, Research Chemist, Armstrong Cork Company, and for mail, 15 North Line Street, Lancaster, Pennsylvania.
- WIEGAND, JOHN, Jr.**, Salesman, 2020 North Marshall Street, Philadelphia, Pennsylvania.
- WILBUR, W. A.**, Banker, South Bethlehem, Pennsylvania.
- WILEY, Dr. H. W.**, Chemist, Room 1120, Woodward Building, Washington, D. C.
- WILHELM, Dr. ROBERT H.**, Chemist, 509 Spruce Street, Philadelphia, and for mail, 1 Cleveland Avenue, Narberth, Pennsylvania.
- WILKIN, JOHN T.**, President and Engineer, The Connersville Blower Company, and for mail, 905 Grand Avenue, Connersville, Indiana.
- WILCOX, DUDLEY**, Ajax Electrothermic Corporation, Trenton, New Jersey.
- WILCOX, JAMES M.**, Wawa, Delaware County, Pennsylvania.
- WILCOX, W. F.**, Darling Post Office, Delaware County, Pennsylvania.
- WILE, H. V.**, Vice-President, The Baldwin Locomotive Works, The Standard Steel Works Company, 500 North Broad Street, Philadelphia, Pennsylvania.
- WILLIAMS, ALFRED L. W.**, Engineer, 1814 Spruce Street, Philadelphia, Pennsylvania.
- WILLIAMS, E. D.**, Attorney-at-Law, 560 Drexel Building, Philadelphia, Pennsylvania.
- WILLIAMS, IRA JEWELL**, Attorney-at-Law, 1005 Morris Building, 1421 Chestnut Street, Philadelphia, Pennsylvania.
- WILLIAMS, Dr. STEVENSON A.**, Lawyer, Bel Air, Maryland.
- WILLIAMS, T. W.**, Plant Department, Bell Telephone Company, 1835 Arch Street, Philadelphia, Pennsylvania.
- WILLIAMS, Dr. WILLIAM J.**, Chemist, 1208 Haworth Street, Frankford, Philadelphia, Pennsylvania.
- WILLIAMSON, J. D., Jr.**, Vice-President, American Engineering Company, Latham Park, Oak Lane P. O., Philadelphia, Pennsylvania.
- WILLIS, L. M. R.**, Lawyer, 213 St. Paul Place, Baltimore, Maryland.
- WILSON, ALEXANDER**, 3rd, Mechanical Engineer, 108 West Baltimore Avenue, Lansdowne, Pennsylvania.
- WILSON, ARTHUR M.**, Insurance, 434 Walnut Street, Philadelphia, Pennsylvania.
- WILSON, H. A.**, Coronado Apartments, 22nd and Chestnut Streets, Philadelphia, Pennsylvania.
- WILSON, H. D.**, Coronado Apartments, 22nd and Chestnut Streets, Philadelphia, Pennsylvania.
- WILSON, HENRY W.**, Civil Engineer, 909 Clinton Street, Philadelphia, Pennsylvania.
- WILSON, JAMES E.**, 910 South 49th Street, Philadelphia, Pennsylvania.
- WILSON, J. HUNT**, Professor of Chemistry, Lafayette College, 531 Cattell Street, Easton, Pennsylvania.
- WILSON, J. L.**, Hotel Idlewild, Media, Pennsylvania.
- WILSON, JOHN S.**, Inspector, 429 W. Pratt Street, Baltimore, Maryland.
- WILSON, Dr. WILLIAM**, Engineer, American Telephone and Telegraph Company, 195 Broadway, New York City, and for mail, Jefferson Road, Short Hills, New Jersey.
- WOLF, JOHN JACOB**, 927 North 5th Street, Philadelphia, Pennsylvania.
- WOOD, ALAN**, 3rd, Mechanical Engineer, 615 Pembroke Road, Bryn Mawr, Pennsylvania.
- WOOD, ALBERT C.**, Consulting Mechanical Engineer, Stock Exchange Building, Philadelphia, Pennsylvania.
- WOOD, BIDDLE**, Iron Manufacturer, Conshohocken, Pennsylvania.
- WOOD, E. R., Jr.**, Mechanical Engineer, 409 Chestnut Street, Philadelphia, Pennsylvania.
- WOOD, EDWARD S., Jr.**, Student, Haverford College, Haverford, Pennsylvania, and for mail, Riverton, New Jersey.
- WOOD, F. W.**, President, Maryland Steel Company, and for mail, Keyworth Avenue, Baltimore, Maryland.
- WOOD, ROBERT L.**, Civil Engineer, Erdenheim Post Office, Montgomery County, Pennsylvania.
- WOOD, WALTER**, Manufacturer, 400 Chestnut Street, Philadelphia, Pennsylvania.
- WOODBIDGE, J. LESTER**, Electrical Engineer, 19th Street and Allegheny Avenue, Philadelphia, Pennsylvania.
- WOODBURY, C. A.**, Director, Eastern Laboratory, E. I. du Pont de Nemours and Company, Drawer 424, Chester, Pennsylvania.
- WOODHOUSE, HENRY**, Editor, Foster Building, Madison Avenue and 40th Street, New York City, New York.
- WOODLE, ALLAN SHELDON, Jr.**, Engineer, The Baldwin Locomotive Works, Philadelphia, and for mail, Ridley Park, Pennsylvania.
- WOODROFFE, G. H.**, Mechanical and Metallurgical Engineer, Reading Iron Company, Reading, Pennsylvania.
- WOODWARD, GEORGE**, Physician, 708 North American Building, Philadelphia, Pennsylvania.

- WOOLMAN, EDWARD**, Mechanical Engineer, N. W. corner Buck and Panmure Roads, Haverford, Pennsylvania.
- WORRELL, HOWARD SELLERS**, Engineer, 100 East Montgomery Avenue, Ardmore, Pennsylvania.
- WRIGHT, FRANK L.**, Factory Metallurgist, Atlas Ball Company, 4th Street and Glenwood Avenue, Philadelphia, Pennsylvania.
- WRIGHT, JAMES A.**, Wright-Fisher Engineering Company, 650 Dorchester Street, West Montreal, Canada.
- WRIGHT, ORVILLE**, Aeronautical Research Engineer, 15 North Broadway, Dayton, Ohio.
- WRIGHT, ROY V.**, Editor, in care of *Railway Age*, 30 Church Street, New York City, New York.
- WRIGHT, SYDNEY L., Jr.**, Chemist, Pennsylvania Hospital, 8th and Spruce Streets, Philadelphia, Pennsylvania, and for mail, Greene Street and School House Lane, Germantown, Philadelphia, Pennsylvania.
- WRIGHT, WINTHROP R.**, Professor of Physics, Swarthmore College, and for mail, 4 Whittier Place, Swarthmore, Pennsylvania.
- WURTS, CHARLES S.**, Broker, 608 Real Estate Trust Building, and for mail, 926 Spruce Street, Philadelphia, Pennsylvania.
- WYATT, JAMES H.**, Electrical Engineer, Cutter Electric and Manufacturing Company, 19th and Hamilton Streets, Philadelphia, Pennsylvania.
- WYATT, J. R.**, The Ajax Metal Company, Frankford Avenue and Richmond Street, Philadelphia, Pennsylvania.
- WYETH, FRANCIS H.**, Sales Engineer, Leeds and Northrup Company, 4901 Stenton Avenue, Philadelphia, Pennsylvania.
- WYLE, BRUCE**, Reading Company, Reading Terminal, Philadelphia, Pennsylvania.
- YARNALL, D. ROBERT**, Mechanical Engineer, Chestnut Hill, Philadelphia, Pennsylvania.
- YEOMANS, LUCIEN I.**, Industrial Engineer, President, Lucien I. Yeomans, Incorporated, 53 West Jackson Boulevard, Chicago, Illinois.
- YORK, H. W.**, Consulting Engineer, 120 Broadway, New York City, New York.
- YORKER, GEORGE M.**, Engineer, 195 Broadway, New York City, New York.
- YOUNG, CHARLES A.**, Teacher, Eighth Street and Lehigh Avenue, Philadelphia, and for mail, Somerton, Philadelphia, Pennsylvania.
- YOUNG, J. BERTRAM**, Chemist, Philadelphia and Reading Railway Company, Reading, Pennsylvania.
- ZEEMAN Dr. PIETER**, Stadhouderskade, 158 Amsterdam, Holland.
- ZEHNDER, CHARLES H.**, Coal and Iron Merchant, Room 3018, 120 Broadway, New York City, New York.
- ZIEGLER, GEORGE W.**, Address unknown.
- ZIESEL, EDWARD L.**, Student, Laboratory of the Big Sisters Hospital, Ventura, California.
- ZILEN, VICTOR W.**, Mechanical Engineer, 318 Auburn Avenue, Buffalo, New York.
- ZIMMERMANN, JOHN E.**, Mechanical Engineer, Member of Firm, Day and Zimmermann, 1600 Walnut Street, Philadelphia, Pennsylvania.
- ZIMMERMANN, WILLIAM**, Manufacturer of Textiles, 22nd Street and Lehigh Avenue, and for mail, 1512 West Allegheny Avenue, Philadelphia, Pennsylvania.

GEOGRAPHICAL DISTRIBUTION OF MEMBERS

ADDRESS UNKNOWN

John Byrd.
Henry S. Hale.
Franklin M. Harris.
William B. Keefer.
John H. Kennedy.
Mrs. R. H. Krischker.
W. G. Matthews.
George McCall.
Peter H. Murphy.
John E. Nethery.
John Richards.
O. A. Turner.
George W. Ziegler.

ALABAMA

Birmingham
Hamilton, W. B.
Salmon, F. W.

CALIFORNIA

Berkeley
Hersam, Ernest A.
McMeekin, C. W.
Beverly Hills
Shattuck, A. F.
Coronado
Longstreth, Charles.
Los Angeles
Ballard, R. H.
MacMurphy, F. M.
Severy, Melvin L.
Thomas, C. C.
Pasadena
Barnhart, G. Edward.
Pease, Francis G.
Ricketts, L. D.
Spitz, Samuel.
Stutz, Ernest.
San Diego
Stone, John Stone.
San Francisco
Quinn, C. H.
Santa Barbara
Cooper, Henry.
Stanford University
Alsberg, Carl L.
Stockton
Kistler, S. S.
Ventura
Ziesel, E. L.

COLORADO

Colorado Springs
Hawkins, R. J. D.

CONNECTICUT

Bridgeport
Bert, M. O.
Cheshire
Bassett, W. H.
Hartford
Rice, Charles D.
Veeder, Curtis H.

New Haven

Barth, Carl G.
Johnston, John.
Sargent, Henry B.
Swann, W. F. G.

Stamford

Getman, Frederick H.

Waterbury

Thompson, Hugh L.

DELAWARE

Bellevue

Sellers, Richard.
Sellers, Mrs. William.

Edgemoor

Sellers, William F.

Henry Clay

Tanberg, Arthur P.

Newark

Townend, R. V.

Newport

Berg, Holger V.
Krebs, A. S.
Krebs, H. J.

Wilmington

Ashbrook, Donald S.
Bancroft, John.
Bancroft, Joseph.
Blatz, Frederick J.
Bolton, Elmer K.
Canby, H. M.
Casey, K. K. V.
Chambers, A. D.
Coppage, B. Denver.
Coppage, George L.
Du Pont, Irene.
Du Pont, Pierre S.
Ellis, Wm. G.
Glover, Rolfe E., Jr.
MacGregor, Frank S.
Maxfield, H. H.
Reese, Charles L.
Robinson, Edmund G.
Spruance, W. C.
Tatnall, Robert R.
Van Trump, S. N.

DISTRICT OF COLUMBIA

Washington

Allen, James.
Austin, Louis W.
Berliner, Emile.
Capps, W. L.
Clark, Edward B.
Coyle, George L.
Day, Arthur L.
Delano, Frederick A.
Ettinger, R. L.
Hammond, John M.
Hersey, Mayo D.
Humphreys, W. J.
Jenkins, C. Francis.
Jodidi, Samuel L.
Knapp, I. N.
Kunsman, Charles H.
Lewis, George W.
Lloyd, Morton G.
Moore, David Pelton.

Washington—Continued

Nutting, P. G.
 Pershing, John J.
 Rothermel, John J.
 Sands, B. W.
 Sklar, S. B.
 Spencer, H. B.
 Squier, George Owen.
 Stanford, H. R.
 Szokley, James.
 Taylor, D. W.
 Wiley, H. W.

FLORIDA

Coral Gables
 Sulzner, C. F.
Daytona Beach
 Drake, Lewis Marvin.
Jacksonville
 Fleming, Francis P.
 Gibbs, E. L.
Punta Gorda
 Price, Max Charles.

GEORGIA

Augusta
 Bates, Onward.
Atlanta
 Adsit, Charles G.
 Bennett, O. E.

ILLINOIS

Chicago
 Bannister, J. O.
 Becker, Irwin A.
 Billow, O. O.
 Converse, W. A.
 Davidson, G. M.
 Duncan, J. S.
 Egloff, Gustav.
 Elmendorf, Armin.
 Felton, Samuel M.
 Ferguson, Louis A.
 Gibbs, Webb L.
 Gilchrist, John F.
 Gudeman, Edward.
 Hoskins, William.
 Insull, Samuel.
 Jones, W. Olyde.
 Koch, E. L.
 Lathrop, Elbert C.
 Lyman, James.
 McCormack, H.
 Michelson, A. A.
 Monroe, W. S.
 Neller, Samuel G.
 Nordhaus, C. H.
 Otis, Spencer.
 Pearson, Frederick J.
 Purcell, John.
 Ritter, Louis E.
 Spitzglass, J. M.
 Uhner, Carl D.
 Van Deventer, Christopher.
 Wertheim, F. E.
 Widdicombe, R. A.
 Yeomans, Lucien I.

Evanston
 Carter, Edward C.

Geneva
 Kranz, F. W.
 Sabine, Paul E.

Oak Park
 Parrish, T. R.

Riverside
 Sillico, L. K.

Urbana
 Parr, S. W.

Wheaton
 Finley, W. H.

INDIANA

Connersville
 Wilkin, John T.
Fort Wayne
 Denig, Fred.

Indianapolis
 Andrus, Lucius B.
 Ferguson, John.
 Spencer, Thomas.

Lafayette
 Duncan, Thomas.

La Porte
 Ballentine, William I.

IOWA

Iowa City
 Bartow, Edward.

KENTUCKY

Trappist
 Biddle, James C., Jr.

LOUISIANA

Natchitoches
 Sharp, Harry M.
Shreveport
 Maislish, Israel.

MAINE

Rumford
 Mixer, Charles A.

MARYLAND

Baltimore
 Ames, Joseph S.
 Atlee, Walter.
 Blackburn, Arthur.
 Bloede, V. G.
 Claghorn, Clarence R.
 Eberle, E. G.
 Emerson, G. H.
 Gittleson, Frank.
 Logan, Lloyd.
 Wagner, Fred. H.
 Wagner, Herbert A.
 Willis, L. M. R.
 Wilson, John S.
 Wood, F. W.

Bel Air
 Williams, S. A.

Berwyn
 Budd, A. Van Wyck.

Centreville
 Tilghman, B. O.

Cumberland
 McKaig, W. Wallace.

Dunkirk
 Dashiell, Benjamin J.

Elkton
 Thomson, F. Du Pont.

Riderwood
 Homer, F. T.

MASSACHUSETTS

Bass River
 Davis, Charles Henry.

Boston

Bryant, Alice G.
 Cabot, George E.
 Clark, Frank Shaw.
 Edgar, C. L.
 Greenwood, T. T.
 Harman, J. J.
 Lawler, G. S.
 Moyer, J. A.
 Peterson, Walter.
 Robb, Russell.
 Talbot, H. P.

Cambridge

Bauer, P. S.
 Chaffee, E. Leon.
 Comey, A. M.
 Kennelly, A. E.
 Little, Arthur D.
 Richards, Theodore W.

Chestnut Hill

Dellenbaugh, Fred S.

Fall River

Johansen, Ernest.

Great Barrington

Pope, Ralph W.

Lynn

Coates, Jesse.

Pittsfield

Peek, F. W., Jr.

Springfield

Morris, Albert W.

Swampscott

Thomson, Elihu.

Wakefield

Skinner, H. J.

Worcester

Fortier, M. L.
 Saunders, Louis E.

MICHIGAN**Ann Arbor**

Bigelow, S. L.
 Cooley, M. E.
 Gomberg, Moses.

Birmingham

Keller, E. E.

Detroit

Berresford, A. W.
 Caton, J. J.
 Heitman, Edward.
 Lawrence, Russell E.
 Morrissey, John P.

Iron River

Byers, Isaac W.

Jackson

Kellers, Charles F.

Midland

Dow, Herbert H.

MINNESOTA**Minneapolis**

Hicks, Thomas W.

Nicollet

Summers, C. J.

MISSISSIPPI**Ocean Springs**

Guthrie, Bayard.

MISSOURI**Kansas City**

Oberle, Alfred.
 Weeks, Edwin R.

St. Louis

Caspari, Charles E.
 Dempsey, W. L.
 Frerichs, F. W.
 Garrels, W. L.
 Kinealy, J. H.
 Mallinckrodt, E., Jr.

NEW HAMPSHIRE**Chesham**

Lightfoot, Thomas M.

Danbury

Murdock, Joseph B.

Portsmouth

Umstead, C. H.

NEW JERSEY**Bloomfield**

Shackelford, B. E.

Bloomington

Donald, William.

Camden

Bardo, C. L.
 Casselman, William S.
 Fitta, J. Logan.
 Kerlin, W. D.
 Kramer, D. F.
 Kretz, Julius, Jr.
 McGowen, J., Jr.
 Olsen, Wm. A.
 Rambo, S. M.
 Ringwalt, Rowland.
 Sauer, Frank H.

Delanco

Perkins, G. W.

Elizabeth

Smith, A.

Englewood

Gubelman, F. J.

Gloucester

Knoedler, E. L.
 Mason, Sidney.
 Miner, Harlan S.
 Ritchie, Kenneth M.

Haddonfield

Braddock-Rogers, K.
 Bruce, Wm. D.
 Smith, W. A.
 Valentine, W. P.
 Vogt, C. C.

Hammononton

Cottrell, James W.

Harrison

Allan, Andrew, Jr.
 Howell, J. W.

Hoboken

Burhorn, Edwin.
 Humphreys, A. C.

Jersey City

Holmes, George R.
 Ittner, Martin Hill.

Laurel Springs

Andreau, Roland L.

Merchantville

Hensel, W. G.
 Patterson, Edward B.

Millville

Furness, George W.
 Lewis, Daniel C.

Montclair

Ellis, Carleton.
Gesell, William H.
Loeb, Leo.
Steuber, Henry J.

Moorestown

Middleton, Albert C.

New Brunswick

Waldron, William H.

Newark

Weston, Edward.

Orange

Colvin, Fred. H.
Edison, Thomas A.
Egleston, J. E.
Kilpatrick, J. L.
Pitman, John.
Wellman, Noel T.

Paulsboro

Oakleaf, J. F.

Pennsgrove

Douglass, W. A.

Plainfield

Condict, G. H.
Livingston, H.

Princeton

Adams, E. P.
Greene, Arthur M.
Lewis, Paul A.
Northrup, E. F.
Rogers, T. M.
Trowbridge, Augustus.

Rahway

Forrest, Charles N.
Kippenburg, Henry.
Murray, B. L.

Riverton

Atlee, Joshua W.
Biddle, Charles M.
Evans, H. C.
Flanagan, Charles L.
Flanagan, Louis A.
Murray, H. H.
Randall, H. L.
Wood, E. S., Jr.

Rutherford

Rector, Thomas M.

Secaucus

Smith, E. A.

Sewaren

Cowles, Alfred H.

Short Hills

Badenhausen, Carl W.
Wilson, William.

Summit

Gilpin, Francis H.

Trenton

Porter, H. F.
Willcox, D.

Ventnor

Burk, C. A. D.
Burk, Edwin H.

Vineland

Greene, Joseph F.

Wildwood Crest

King, Charles W. G.

Brooklyn

Colvin, Charles H.
Colvin, Fred H., and.
Cowan, Wm. A.
Davidson, W. F.
Foley, J. G.
Hooker, Samuel C.
McFarlane, M. L. D.
Sperry, Elmer A.
Vogt, A. C.
Wells, W. F.

Buffalo

Bierbaum, C. H.
Calkins, G. H.
Grissinger, Elwood.
Zilen, Victor W.

Corning

Gage, Henry Phelps.

Ithaca

Barr, John.
Poole, Arthur F.

Long Island City

Adams, Merrit H.
D'Utassy, George.
Oatley, H. B.
Silva, A. D.

Mount Vernon

Macalpine, J. K. W.

New York City

Acheson, E. G.
Addicks, Walter R.
Arnold, H. D.
Army, H. V.
Bacon, Raymond F.
Bell, J. Snowden.
Bourne, George L.
Bradley, A. L.
Briesen, Fritz V.
Buck, H. W.
Buckley, O. E.
Bullock, William E.
Bunnell, Sterling H.
Carty, John J.
Craig, Robert.
Cushman, A. S.
Darrow, K. K.
Day, R. B.
Detwiler, J. G.
Dickerson, Edward N.
Doherty, Henry L.
Dorr, John V. N.
Douthirt, Walstein F.
Dubilier, William.
DuBosque, F. L.
Dunn, Gano.
Dyer, F. L.
Eldred, Byron E.
Emerson, Harrington.
Engelhard, Charles.
Erhart, W. H.
Falkenau, Arthur.
Fairchild, Sherman M.
Finch, Harold H.
Fries, Harold H.
Fuller, George W.
Gherardi, Bancroft.
Gibson, John J.
Granbery, J. H.
Griswold, Robert G.
Hallberg, J. H.
Hammer, Edwin W.
Hammer, William J.
Haschka, Ferd. T.
Hazen, Allen.
Hendrick, Elwood.
Herr, Edwin M.
Herty, Charles H.

NEW YORK**Bronxville**

Waller, Alfred E.

New York City—Continued

Hirschland, F. H.
 Honaman, R. K.
 Howard, A. O.
 Ives, Herbert E.
 Jackson, John Price.
 Jacobus, D. S.
 Junkersfeld, Peter.
 Kaufmann, H. M.
 Kennedy, J. J.
 Kingsbury, E. F.
 Knox, Henry Hobart.
 Kunz, George F.
 Lewis, N. B.
 Lewis, Nathan E.
 Lieb, J. W.
 Lieber, Hugo.
 Lindenthal, Gustav.
 Lucas, Francis F.
 Lucke, Charles E.
 Lynch, J. C.
 MacBeth, Norman.
 McKeehan, L.
 Mackenzie, K. G.
 Mailloux, O. O.
 Manker, F. W.
 Manning, J. H.
 Mayer, Nelson B.
 Melcher, William C. Jr.
 Merriman, Thaddeus.
 Merahon, Ralph D.
 Metz, Eugene.
 Metz, Herman A.
 Moran, Daniel E.
 Muller, R. H.
 Murray, Thomas E.
 Murray, William S.
 Nichols, William H.
 Orrok, George A.
 Osbourne, L. A.
 Parish, LeGrand.
 Perry, Robert S.
 Pope, Frederick.
 Postlethwaite, C. E.
 Ramsey, George W.
 Ranger, Richard H.
 Rautenstrauch, Walter.
 Reber, Samuel.
 Reno, Jesse W.
 Reoch, Alexander E.
 Richardson, Charles E.
 Ridgway, Robert.
 Roller, Frank W.
 Rooney, Frederick M.
 Rosenbaum, W. A.
 Savage, H. D.
 Schlafge, William.
 Sharp, Clayton H.
 Smith, A. T.
 Smith, Frank W.
 Smith, J. Waldo.
 Snare, F.
 Snook, H. Clyde.
 Southall, James P. C.
 Spicer, H. N.
 Sporn, P.
 Sprague, Frank J.
 Sprong, S. D.
 Stillwell, Lewis B.
 Symons, W. E.
 Teeple, John E.
 Tikhonovitch, Benedict.
 Toch, Maximilian.
 Torchio, Philip.
 Underwood, Frederick D.
 Van Deventer, H. R.
 Vreeland, Frederick K.
 Waddell, J. A. L.
 Wadleigh, F. R.

New York City—Continued

Wallerstein, Leo.
 Webster, Albert L.
 Weiss, J. M.
 Woodhouse, Henry.
 Wright, Roy V.
 York, H. W.
 Yorke, George M.
 Zehnder, Charles H.

Niagara Falls

Fitzgerald, Francis A. J.
 Lidbury, F. A.

Rochester

Olark, Herbert A.
 Dorsey, F. F.
 Kubale, J. C.
 Mees, C. E. K.
 Nichols, E. B.
 Poser, M.
 Potter, Rowland S.
 Thompson, R. G.

Rye

Robinson, Dwight.
 St. John, Ancel.

Scarsdale

Atwater, R. M., Jr.

Schenectady

Andrews, W. S.
 Berg, Ernst J.
 Berg, P. Eskil.
 Capp, John A.
 Hoadley, Anthony DeH.
 Keith, O. P.
 Lichtenberg, Chester.
 Lovejoy, J. R.
 Rice, E. W.
 Stevenson, Alexander R.
 Stone, O. W.
 Trench, W. W.
 Vaughn, F. G.
 Vogdes, Francis B.

Syracuse

Fryer, George G.

Tarrytown

Whyte, F. M.

Troy

Caird, James M.
 Mason, W. P.

Tuxedo Park

Loomis, A. L.

Voorheesville

Horton, Robert S.

Warwick

Hitchcock, Fanny R.

Woodhaven

Halsey, William B.

Yonkers-on-Hudson

Baekeland, L. H.

NORTH CAROLINA

Asheville

Rumbough, John B.

OHIO

Akron

Jones, Philip C.

Cincinnati

Anderson, R. J.
 Freeman, W. W.
 Lloyd, John Uri.
 Muller, E. A.

Cleveland

Abbott, Robert R.
Cox, J. D.
Doane, Samuel E.
Gfrorer, A. H.
Jefferies, Zay.
Karrer, Enoch.
Lihme, I. P.
Luckiesh, M.
MacBain, D. R.
Oetting, O. W. A.
Parkin, Chas. H.
Smith, Albert W.
Smith, G. W. Jr.

Columbus

Smith, Iowa.
Stout, Orin C.

Dayton

Ohmer, Will I.
Tait, Frank M.
Toulmin, H. A.
Wright, Orville.

Masillon

Mitchell, W. M.

Middletown

Eppelshimer, Daniel.

Worthington

Fitz, E. M.

OKLAHOMA

Ponca City

Eckhardt, E. A.

OREGON

Grants Pass

Canby, William W.

Portland

Bilyeu, Thomas.

PENNSYLVANIA

Abington

Merritt, James Smith.

Allentown

Trexler, Harry O.
Sargent, O. E.
Snelling, Walter O.

Altoona

Koch, G. B.
Pease, F. N.

Ambler

Hagar, Walter F.
Smith, Irving B.

Ardmore

Bright, John Irwin.
Erne, Alfred.
Kent, A. Atwater.
Sellers, Horace W.
Spackman, H. S.
Worrell, Howard S.

Bellevue

Lower, Nathan M.

Bethayres

Lippincott, Joseph W.

Bethlehem

Ford, Terrance.
Kinnler, G. E.
Rau, Albert George.
Richards, O. R.
Wilbur, W. A.

Bridgeport

Landt, G. E.

Bryn Athyn

Boericke, Felix A.
Howard, Wilfred.

Bryn Mawr

Barnes, James.
Crenshaw, James L.
Ferree, Clarence Errol.
Fieser, L. F.
Horn, David W.
Pillmore, G. U.
Schlacke, C. H.
Smith, W. Hinckle.
Townsend, J. W.
Vaux, George, Jr.
Wood, Allen, 3rd.

Bristol

Hollander, Charles S.
Nielsen, D.

Brookline

Holst, L. J. R.

Butler

Christianson, A.

Burnham

Skinner, O. C.

Chester

Hart, Charles.
Kucher, A. A.
Nethery, H. J. W.
Palmer, T. Chalkley.
Palmer, Walter.
Shattuck, John D.
Stevenson, S. Price.
Wetherill, Robert.
Woodbury, C. A.

Chester Heights

Moore, Horace E.

Christiana

Bondon, L. B.

Clearfield

Graham, W. F.

Coatesville

Huston, Chas. L.
Ridgway, Ellis B.
Ridgway, William H.

Conshohocken

Wood, Biddle.

Cynwyd

Haupt, Lewis M.

Darkey

Willcox, W. F.

Devon

Walker, J. W.
Welsh, Francis Ralston.

Easton

Brown, G. S.
Cornelius, J. O.
Hart, Edward.
Raymond, Ward.
Shimer, Porter W.
Wilson, J. Hunt.

Elkins Park

Lamb, Newton.

Elwood City

Brownstein, Benjamin.

Erdenheim

Wood, Robert L.

Erie

Durban, Thomas E.

Franklin

Rhoades, Joseph J.

- Fullerton**
Kinyon, A. G.
- Glen Moore**
Howson, Emily E.
- Glenolden**
Nichols, Leon W.
- Greenburg**
Donohoe, John P.
- Harrisburg**
Irons, Robert H.
Masters, Frank M.
- Haverford**
Bailey, Raymond.
Bostwick, J. V.
Curwen, Samuel M.
Felton, E. C.
Klemm, J. G., Jr.
Lewis, Wilfred.
Lohmann, A. P.
Measey, William M.
Moore, Coleman B.
Morris, A. Saunders.
Palmer, Frederick.
Robinson, Anthony W.
Sawtelle, William Otis.
Sharpe, J. S.
Sleaser, George J.
Woolman, Edward.
- Hazleton**
Markle, A.
- Irwin**
Miles, J. Walter.
- Jenkintown**
Benzon, George H., Jr.
Brewer, R. W. A.
Gibson, Henry Clay.
Goodwin, Harold, Jr.
Keller, H. H.
Newbold, C. B., Jr.
Redding, Chas. S.
- Johnstown**
Crichton, Andrew B.
- Kennett Square**
Phillips, Edwin S.
- Lancaster**
Adams, B. F.
Widmyer, J. H.
- Lansdowne**
Andersen, Robert.
Deshong, Howard T.
Huttinger, W. R.
Keay, L. K.
Pennock, George L.
Roberts, Charles C.
Wilson, Alexander, 3rd.
- Lock Haven**
Dunn, Chas.
- Mahanoy Plane**
Sloatman, W. S.
- Marcus Hook**
Griffin, Frank H.
Smith, W. Leigh.
- Mechanicsburg**
Strong, William Walker.
- Media**
Bell, J. P.
Wilson, J. L.
- Melrose Park**
Hyatt, Clinton Brown.
- Merion**
Boericke, John J.
Davis, R. W.
Eglin, A. C., Jr.
Shand, A. C.
- Millbourne**
Sellers, Howard.
- Millersville**
Davidheiser, Lee.
- Minersville**
Snyder, Clinton F.
- Moylan**
Sanderson, R. P. C.
- Narberth**
Bates, C. W.
Snyder, Monroe B.
Wilhelm, R. H.
- New Hope**
Miller, Fred. J.
- Norristown**
Place, Samuel.
Stinson, Robert.
- Oakmont**
Eisey, H. M.
- Paoli**
Smith, P. F., Jr.
- Parksburg**
Beale, Horace A., Jr.
- Phoenixville**
Rapp, I. M.
Wetherill, H. E.
- Philadelphia**
Abrams, Peter.
Adams, Wm., Jr.
Aiken, Frank.
Akimoff, Nicholas W.
Albrecht, A. O.
Albrecht, Herman O.
Allen, Arthur H., Jr.
Allen, Henry B.
Allen, William N.
Anderson, Cyrus N.
Armstrong, William R.
Arnstein, H.
Ashhurst, John.
Ashworth, H.
Atterbury, W. W.
Austin, W. L.
Ayers, Eugene E.
Babcock, A. F.
Baker, George F.
Balch, Alfred C.
Balls, William H.
Baldwin, Frederic E.
Banta, Clifford.
Barba, M. B.
Barnes, John H.
Barnett, Edwin S.
Barringer, D. M.
Bates, E. F.
Bazzoni, C. B.
Beale, Leonard T.
Beath, E. R.
Behr, Leo.
Belfield, T. B.
Bement, A. C.
Bement, W. P.
Bennett, J. S.
Biddle, Elizabeth C.
Biddle, Robert.
Bilgram, Hugo.
Binder, Richard L.
Rinswanger, J. G.
Birkinbine, Carl P.
Blackburn, Caroline D.
Blair, A. A.
Blake, A. E.
Blum, Arthur N.
Bodine, G. L., Jr.
Bodine, S. T.
Boekel, J.
Boley, O. H.

Philadelphia—Continued

Bonine, Charles E.
 Bonn, N. E.
 Boos, H. C.
 Boric, Beauveau Jr.
 Borton, George W.
 Bower, W. H.
 Bowen, Samuel B.
 Boyer, Murray O.
 Bradbury, Robert H.
 Brady, Edward J.
 Breed, George.
 Brewer, J. E.
 Brightcliffe, N. J.
 Brinley, Charles E.
 Brinton, Clement Starr.
 Brinton, R. L.
 Brock, John W.
 Bromley, Joseph H.
 Brooke, F. M.
 Brown, Francis Shunk.
 Brown, Richard P.
 Brown, W. L.
 Brunker, Robert J.
 Budd, Edward G.
 Budd, Edward G., Jr.
 Bureau, E. W.
 Burroughs, Joseph H.
 Burton, M. C.
 Busser, Frank S.
 Butts, Donald C. A.
 Calvert, Harold.
 Capp, S. Bunker.
 Card, P. Q.
 Cary, C. Reed.
 Chambers, Francis T.
 Chambers, J. Howard.
 Chance, E. M.
 Chance, H. M.
 Chandler, T. P.
 Charlton, Richard C.
 Church, Arthur L.
 Clamer, G. H.
 Clark, Beauvais.
 Clark, Darthela.
 Clark, E. W.
 Clark, Edward L.
 Clark, Joseph S.
 Clark, Theobald F.
 Clark, Walton.
 Clark, Mrs. Walton.
 Clark, Walton, Jr.
 Clothier, Morris L.
 Clymer, E. M.
 Collins, Henry H.
 Collingswood, J. Reed.
 Collom, Samuel H.
 Conaway, John F.
 Conn, Charles F.
 Cooke, Morris L.
 Cookson, R. B.
 Cope, Thomas D.
 Cornelius, Clarence.
 Cornelius, J. C.
 Cox, John L.
 Cox, Walter.
 Cramp, Francis L.
 Crampton, George S.
 Croasdale, John P.
 Crook, Alfred.
 Crowell, Walter S.
 Cullen, George S.
 Cummings, J. H.
 Curtis, Cyrus H. K.
 Curtiss, Elliott.
 Da Costa, John C. 3rd.
 Dannenbaum, Herman.
 Dashiell, P. T.
 Davis, C. E.
 Dawes, John H.
 Day, Charles.
 DeKraft, W.
 Dellbridge, T. G.
 Dercum, F. X.
 Dieffenbach, A. C.
 Dike, P. H.
 Dilks, W. H.
 Dillenbeck, Clark.
 D'Inwilliers, E. V.
 Disston, William D.
 Dobson, William A.
 Dodge, Kern.
 Dougherty, T. H., Jr.
 Douredoure, Bernard L.
 Downs, W. F.
 Doyle, William J.
 Drexel, John R.
 Dundore, Charles R.
 Dunlap, G. J.
 Easton, G. W., Jr.
 Ecker, Howard.
 Eckert, S. B.
 Eglin, W. O. L.
 Ehrenfeld, Frederick.
 Ehret, O. D.
 Elkins, George W.
 Elkinton, Howard W.
 Elkinton, Thomas W.
 Elliott, Edwin.
 Elverson, James, Jr.
 Emerich, L. E.
 Emerick, J. M.
 Erikson, R. B.
 Erne, Alfred.
 Evans, O. B.
 Evans, Powell.
 Evans, Wayne S.
 Fairchild, S. E., Jr.
 Faught, L. Ashley.
 Fearing, Frederick C.
 Fearon, Charles.
 Fels, Maurice.
 Fels, Samuel.
 Ferguson, W. B.
 Fernald, R. H.
 Finkbinder, E. W.
 Fiore, Andrew.
 Fisher, Thomas.
 Fitzmaurice, William J., Jr.
 Fletcher, W. E.
 Ford, Bruce.
 Forstall, Walton.
 Francis, Isaac H.
 Francis, John K.
 Franklin, Benjamin.
 Frazier, George H.
 Frazier, W. W.
 Fry, Ann W.
 Fuguet, H.
 Fulweiler, W. H.
 Funk, N. E.
 Furness, H. H.
 Furness, Radcliffe.
 Galloway, O. D.
 Garrison, F. Lynwood.
 Gartley, William H.
 Gazzam, J. M.
 Gerhard, Arthur Howell.
 Gest, William P.
 Gibbs, A. E.
 Gibbs, W. S.
 Gibson, Kenneth.
 Gill, John D.
 Gilman, F. W.
 Godfrey, H. L.
 Goetzenberger, Ralph L.
 Goldbaum, Jacob S.
 Goldsmith, Edwin M.

Philadelphia—Continued

- Goodspeed, Arthur W.
 Grafton, E. H.
 Greenwood, Richard.
 Greer, W. N.
 Grevenmeyer, G. A.
 Gribbel, John.
 Gribbel, W. Griffin.
 Griest, Thomas H.
 Griscom, Leslie.
 Grosscup, H. A.
 Gucker, F. T.
 Hachikian, Charles.
 Hackett, H. B.
 Haines, Caspar Wistar.
 Haines, Robert B., Jr.
 Haines, William A.
 Hall, O. A.
 Hall, George R.
 Hanthorn, Joseph R.
 Harris, Bert M.
 Harrison, A. C.
 Harrison, O. C.
 Harrison, G. L.
 Harrison, J. K. M.
 Harrison, Thomas R.
 Harsch, J. W.
 Hartung, Adolph.
 Hartzel, Francis W.
 Hayner, J. W.
 Hayward, Nathan.
 Hellprin, William A.
 Helms, William E.
 Hendrixson, L. H.
 Henson, Edward Francis.
 Hentz, R. A.
 Hepburn, Joseph S.
 Hering, Walter E.
 Hess, J. C., Jr.
 Hiersgessell, Valentine.
 Higgins, E. S.
 Hires, Charles E.
 Hofstetter, George.
 Holland, Walter E.
 Hopping, Ernest L.
 Horn, Franklin S.
 Houston, John J. L.
 Houston, Samuel F.
 Howe, Arthur W.
 Howson, Charles Henry.
 Howson, Henry.
 Howson, Richard.
 Hoy, R. V., Jr.
 Huber, D. M.
 Hughes, R. J.
 Hummell, Willard A.
 Hurst, William.
 Hutchinson, S. Pemberton.
 Hymen, J. D.
 Indahl, Mauritz O.
 Ingersoll, Charles E.
 Irish, W. M.
 Israel, Joseph D.
 Ives, Fred E.
 Jackson, William Steell.
 James, William Fry.
 Jeane, Isaac W.
 Jenkins, Theodore F.
 Jennings, W. N.
 Johnson, O. N.
 Johnson, Ernest.
 Johnson, J. O.
 Johnson, W. H.
 Johnson, William A.
 Jones, Julian D.
 Justi, Henry M.
 Kabakjian, D. H.
 Kaltenthaler, H. J.
 Kavanaugh, William H.
 Kellog, Hosford D.
 Kelly, George L.
 Kennedy, Frank G.
 Kennedy, M. C.
 Kent, S. Leonard, Jr.
 Kercher, M. A.
 Kerr, William M.
 Ketcham, O. W.
 Ketterlinus, J. L.
 Kimber, W. M. C.
 King, Joseph B., Jr.
 Kinnard, L. H.
 Kirsopp, E. C. B.
 Kline, O. M.
 Klump, John Bartleman.
 Knapp, Arthur.
 Kneass, Strickland L.
 Kohn, Joseph.
 Kraus, E. R.
 Krauss, George.
 Kuehn, T.
 Kuesel, G. C.
 Landreth, O. P.
 Lanza, G.
 Laner, Conrad.
 Lavino, E. J.
 LaWall, Charles H.
 Lay, John Tracy.
 Ledoux, J. W.
 Lee, Elisha.
 Lee, James D.
 Lee, Walter T.
 Leeds, Morris E.
 Leffmann, Henry.
 Leighninger, William B.
 LeMaistre, F. J.
 Lemoine, L. R.
 Leopold, L. S.
 Lesley, Robert W.
 Levy, Howard S.
 Levy, Lionel F.
 Lewis, A. Nelson.
 Lewis, Howard W.
 Lewis, John F.
 Lewis, Robert B.
 Lillebridge, H. W.
 Lillie, Lewis.
 Lillie, S. M.
 Littleton, W. G.
 Lippincott, J. Bertram.
 Liversidge, Horace P.
 Lloyd, Herbert.
 Lloyd, Malcolm, Jr.
 Lonergan, J. E.
 Longstreth, E. T.
 Lowe, Arthur W.
 Loyd, Sarah A. C.
 Lukens, Hiram S.
 Lupton, Edward.
 Lyon, Percy S.
 Lysle, Frederic Bowers.
 McAllister, T. S.
 McArthur, George P.
 McBride, Thomas O.
 McCain, G. N.
 McCall, Richard O.
 McConnell, Franklin P.
 McCormick, William.
 McDowell, Charles.
 McGeorge, Percy.
 McLean, William L.
 McVey, John Joseph.
 Macfarlane, J. M.
 Madeira, Percy O.
 Mallery, Otto T.
 Manwaring, A. H.
 Marshall, J. T. W.
 Martin, Thomas S., 3rd.
 Martocello, Joseph A.

Philadelphia—Continued

Masland, Charles H., 2nd.
 Mason, W. C.
 Maury, M. F.
 Mears, A. H.
 Mecker, G. H.
 Mellor, Norman.
 Melody, Michael.
 Merrick, J. Hartley.
 Merrick, J. V.
 Metten, John F.
 Miller, J. M.
 Miller, Simon.
 Milne, David.
 Milne, Francis F., Jr.
 Milner, R. D.
 Mills, George M.
 Missimer, George, Jr.
 Mitchell, Henry F.
 Mitten, T. E.
 Moat, D. E.
 Modjeski, Ralph.
 Moody, Lewis F.
 Morgan, James D.
 Morgan, Marshall S.
 Morris, Edingham B.
 Morse, Withrow.
 Mull, J. H.
 Murray, J. F.
 Nice, Eugene E.
 Nichols, Carroll B.
 Nightingale, Donald A.
 North, R. H.
 Noyes, Stephen H.
 Oerlein, Karl F.
 Olsen, Thorsten Y.
 Olsen, Tinius.
 Outerbridge, A. E.
 Owen, Bartram Ashmead.
 Parker, Edward W.
 Parker, H. C.
 Parker, John O.
 Patterson, Francis D.
 Patterson, J. Edward.
 Paul, H. N.
 Pearson, Joshua.
 Peck, G. L.
 Peck, S. B.
 Pecker, Joseph S.
 Pemberton, Ralph.
 Pender, Harold.
 Penrose, Charles.
 Penrose, R. A. F., Jr.
 Pepper, David.
 Perot, T. M., Jr.
 Perrot, Emile G.
 Pew, J. Howard.
 Picolet, Lucien E.
 Pierce, G. A.
 Plack, W. L.
 Plasm, William.
 Platt, H. H.
 Pond, S. E.
 Porter, Horace C.
 Porter, J. B.
 Porter, Roland G.
 Postles, J. V.
 Potts, Joshua R. H.
 Pressell, George W.
 Price, M. M.
 Quimby, Henry H.
 Raff, A. Raymond.
 Rankin, H.
 Rea, Samuel.
 Reath, Theodore W.
 Rebmann, H. G. R.
 Reichardt, H.
 Reilly, Marion.
 Resnes, Javier.

Richards, Horace O.
 Richardson, William E.
 Rickersberg, S. B.
 Riehle, Fred A.
 Rigling, Alfred.
 Robinson, W. W.
 Rodman, Jessie A.
 Rogers, Frank D.
 Rogers, Frank H.
 Rogers, James S.
 Rolle, Sylvan D.
 Rondinella, L. F.
 Roosevelt, Nicholas G.
 Rosecrans, O. Z.
 Rosen, Joseph.
 Rosenbaum, Morris.
 Rosengarten, Frederic.
 Rosengarten, George D.
 Ross, Howard.
 Ross, R. W.
 Ross, T. Edward.
 Roulton, J. A.
 Rowland, Theodore S.
 Rusby, J. M.
 Rushmore, D. B.
 Russell, Charles J.
 Rust, Henry P.
 Sadtler, Samuel S.
 Safford, Frederick H.
 Sailer, R.
 Salom, Pedro G.
 Samuel, J. Bunford.
 Sanborn, Edward H.
 Sanford, Rufus H.
 Sartain, Paul J.
 Satterthwaite, George.
 Saunders, William E.
 Scannell, Gerald F.
 Schehl, Oscar L.
 Schrom, Oscar G.
 Schwank, J. L.
 Seely, Leslie B.
 Sellers, Alexander.
 Sellers, Coleman, 3rd.
 Senter, Ralph Townsend.
 Shaw, D. N.
 Schmidheiser, W. A.
 Shober, Samuel L.
 Shoemaker, Samuel.
 Shoemaker, Thomas H.
 Shrader, J. E.
 Shuman, F. R.
 Shumay, E.
 Simachn, Julian A.
 Sinkler, John P. B.
 Smalling, Elmer, Jr.
 Smith, A. DW.
 Smith, Edward W.
 Smith, Haseltine.
 Smith, S. D.
 Smith, Walter B.
 Spencer, Paul.
 Sproul, William C.
 Starwick, Charles A.
 Steel, Joseph M.
 Steiner, Oscar.
 Steinmetz, J. A.
 Stevens, John S.
 Stewart, A. V.
 Stewart, Frank H.
 Stewart, Ralph C.
 Stewart, Thomas S.
 Stine, Wilbur M.
 Stockwell, J. W.
 Stoertz, Howard.
 Stokes, Francis J.
 Stotesbury, E. T.
 Stoughton, A. B.
 Stradling, G. F.

Philadelphia—Continued

Stroud, E. A.
 Styri, Haakon.
 Supplee, W. H.
 Swaab, S. M.
 Sykes, John P.
 Synnestvedt, Arthur.
 Taggart, Walter T.
 Tatnall, J. S.
 Taylor, H. Birschard.
 Taylor, Hollingshead N.
 Taylor, Loundes.
 Thomas, Arthur H.
 Thompson, A. W.
 Thompson, Paul.
 Thwing, Charles Burton.
 Tily, H. J.
 Towle, H. L.
 True, Rodney H.
 Trueman, William H.
 Tull, C. E.
 Tuttle, E. B.
 Tuttle, William C.
 Tyler, Sydney F.
 Vail, James G.
 Van Dyke, J. W.
 Vauclair, S. M.
 Vogdes, J. J.
 Vogelsson, John A.
 Vollrath, Alfred J.
 Wagner, John.
 Wagner, Samuel T.
 Wagner, Walter C.
 Waidlich, J. E.
 Wallis, J. T.
 Walton, Horace.
 Warden, William G.
 Warner, William R., Jr.
 Warnock, James.
 Warriner, S. D.
 Watson, James.
 Weatherwax, James Lloyd.
 Webber, G. C.
 Webster, George S.
 Webster, William R.
 Weinberg, S.
 Welles, Howard W.
 Weltz, E. H.
 Wetherill, William C.
 Weyl, Charles N.
 Wharton, Henry.
 Whitaker, James L.
 White, J. Atwood.
 Whitney, E. R.
 Whitney, F. E.
 Wiegand, John.
 Willie, H. V.
 Williams, Alfred L.
 Williams, E. D.
 Williams, Ira Jewell.
 Williams, T. W.
 Williams, William J.
 Williamson, J. D., Jr.
 Wilson, Arthur M.
 Wilson, H. A.
 Wilson, H. D.
 Wilson, Henry W.
 Wilson, James E.
 Wolf, John Jacob.
 Wood, Albert C.
 Wood, E. R., Jr.
 Wood, Walter.
 Woodbridge, J. Lester.
 Woodward, George.
 Wright, Frank L.
 Wright, S. L., Jr.
 Wuriz, C. S.
 Wyatt, James H.
 Wyatt, J. R.

Wyeth, F. H.
 Wyle, Bruce.
 Yarnall, D. Robert.
 Young, C. A.
 Zimmermann, John E.
 Zimmermann, William.

Pittsburgh

Chesterman, F. J.
 Crawford, D. F.
 Cunningham, J. L.
 Didier, Paul.
 Eavenson, Howard N.
 Garman, F. R.
 Gunn, Donald.
 Hower, Harry S.
 Jones, Jonathan.
 Koch, J. A.
 Marbaker, Edward.
 Milliken, J.
 Moore, W. E.
 Rameburg, C. J.
 Rittman, W. F.
 Rugg, W. S.
 Skinner, O. E.
 Sperr, F. W.
 Taber, George H.
 Tiemann, Hugh P.
 Wadsworth, F. L. O.
 Weidlein, Edward R.
 Whitney, Louis B.

Pottstown

Forstall, C. F.
 Fretz, E. S.

Radnor

Scott, William M.

Reading

Hellman, D. B.
 Heiser, C. E.
 Lerch, G. R.
 MacLean, L. W.
 Moorehouse, J. W.
 Thomas, L. E.
 Woodroffe, G. H.
 Young, J. Bertram.

Ridley Park

Manning, E. R.
 Woodie, Allan S., Jr.

Rosmont

Archbald, Sara T.

St. Davids

Freeman, Harold A.

Scottdale

Oberly, Albert D.

Sellersville

Landis, D. O.

Springfield

Kent, R. H.

State College

Wendt, Harold L.

Stratford

Kothny, G. L.

Stroudsburg

Smith, H. S. S.

Sunbury

Lenker, Will G.

Swarthmore

Alleman, Gellert.
 Creighton, H. Jermain.
 Elmore, G. H.
 Hoadley, George A.
 Hollister, S. O.

Parsons, L. A.
Sagebeer, Richard C.
Sellers, Richard C.
Temple, Edward B.
Wright, Winthrop R.

Swedeland
Tiddy, William.

Swissvale
Grondahl, L. O.

Tamaqua
Hill, Roy Linden.
Pratt, Carl D.

Upper Darby
Birch, George W., Jr.
Whitney, C. H.

Verona
Rodman, Hugh.

Villa Nova
Dolan, Thomas J.
McClenahan, John M.

Virginville
Tait, E. H.

Wallingford
Biddle, James G.
Miller, Casper W.
Trautwine, John C., 3rd.

Wawa
Wilcox, James M.

Wayne
Iddles, Alfred.
Le Boutillier, Henry W.
Le Boutillier, Robert.
Redfield, Robert S.

West Chester
Chrisman, C. S.
Cochran, C. B.
Hetzel, Frederic V.

West Conshohocken
Tutwiler C. C.

White Haven
Ballantine, Stuart.

Wyebrooke
Potts, William M.

Wyncote
Kingsford, R. T.

Wynnewood
Boericke, Gideon.
Hall, R. T.
Lovekin, L. D.
Weston, F. W.

RHODE ISLAND

Bristol
Herreshoff, Nathanael G.

Newport
Eppley, Marion.
Norman, Bradford.
Norman, Reginald.
Sims, William S.

Providence
Burlingame, L. D.
Saunders, Walter M.

Saunderstown
Griffith, W. O.

SOUTH CAROLINA

Sumter
Mason, Charles Thomas.

TENNESSEE

Bristol
Whitney, Asa.

Knoxville
Giealer, Jean V.

Nashville
MacDonald, Hunter.

TEXAS

College Station
Neblette, Carrol B.

Galveston
Dawson, W. T.

UTAH

Salt Lake City
Anderson, Frank.

VERMONT

Bennington
Beach, Charles S.

Springfield
Fellows, E. R.
Flanders, Ralph E.
Hartness, James.

VIRGINIA

Charlottesville
Dunnington, F. P.

Hampton Institute
Atkinson, Robert.

Nokcsville
Harrison, Mitchell.

Norfolk
Caples, M. J.

Warrenton
Randolph, A. M.

WASHINGTON

Seattle
Collins, C. R.

Rosario
Moran, Robert.

WEST VIRGINIA

Fairmont
Huff, E. L.

WISCONSIN

Appleton
Power, Archie Dayton.

Belott
Suydam, V. A.

Delafeld
Anderson, G. L.

Madison
Lenher, Victor.
Mathews, J. H.
Swenson, Magnus.

Milwaukee
Beck, M. A.
Frank, Edwin.
Harvey, R. P.
Hatton, T. Chalkley.
Uehling, E. A.
White, A. Raymond.
White, W. M.

FOREIGN

ARGENTINA

Buenos Aires
Gottschalk, Otto.

AUSTRALIA

Sydney
Robertson, H. C.
N. S. Wales
Leech, T. D. J.

BRAZIL

Rio de Janeiro
Billings, A. W. K.
Ortenblad, Rodolpho.

CANADA

Lachine
Berliner, Herbert S.
Montreal
Eve, A. S.
Job, Robert.
Matheson, H. W.
Reilly, H. E.
Shaw, A. Norman.
Vaughan, H. H.
Wright, James A.
Toronto
Miller, W. L.

CHINA

Canton
Laird, Clinton N.

DENMARK

Copenhagen
Bohr, Niels.

ENGLAND

Cambridge
Rutherford, Ernest.
Thomson, Joseph J.
London
Clond, John W.
Forbes, George.
Gordon, Hugh S.
Hornsey, John W.
Merz, Charles H.
Tate, Alfred O.
Unwin, William Cawthorne.
Newcastle on Tyne
Parsons, Charles A.
Oxford
Townsend, John Sealy.

FRANCE

Paris
Cuvencof, Christo.
Fabry, Charles.
Ferre, G.

GERMANY

Berlin
Thurrow, W. H.
Heidelberg
Goldschmidt, V.

HOLLAND

Amsterdam
Zeeman, Pieter.
Eindhoven
De Graaff, Antonius.
Haarlem
Lorentz, Henrik A.

INDIA

Calcutta
Fleming, Andrew.

ITALY

Rome
Marconi, Guglielmo.

JAPAN

Kawasaki
Nakamura, H.
Tokyo
Matunaga, Yominibu.

NEW ZEALAND

Wellington
Cockerill, H. W.

NORWAY

Oslo
Anderson, Olaf.
Lobben, Peder.
Loss, Henrik von Z.

PHILIPPINE ISLANDS

Manila
Selga, M.

PORTO RICA

Fajardo
Crage, W. H.

SOUTH AFRICA

Cape Town
Van der Lingen, J. Stephen.

SWEDEN

Stockholm
Arrhenius, Svante A.

Important New Scientific Publications

RADIO FREQUENCY MEASUREMENTS. By E. B. MOULLIN, M.A. A.M. I.E.E.

This new work on the theory and practice of radio frequency measurements overcomes many technical difficulties which have heretofore confronted the experimenter. 278 Pages. 134 Illustrations.

ELECTRICAL PHOTOMETRY AND ILLUMINATION. A Treatise on Light and its Distribution, Photometric Apparatus, and Illuminating Engineering. By HERMAN BOHLE. New Edition. Photometry and Illuminating Engineering have never been more accurately discussed than in this new enlarged work. 320 Illustrations and 59 Tables.

STEAM TURBINES. By GIUSEPPE BELLUZZO, Professor of the Polytechnic, Milan, Italy. Translated by Engineer Captain A. G. Bremner, O.B.E.R.N. The long awaited English version gives for the first time a summary of the experimental research carried out by Belluzzo and his chief investigators. 746 Pages. 752 Illustrations.

PETROLEUM. By SIR BOVERTON REDWOOD, Bart. New Edition. Revised and Reset. In Three Volumes with Plates, Numerous Illustrations in the Text and Many New Maps Especially Prepared for this Edition. 1353 Pages.

HANDBOOK OF INDUSTRIAL OIL ENGINEERING. By JOHN ROME BATTLE, B.S., M.E. 1100 Pages, Thumb Index, 350 Illustrations, 40 Curves, 100 Useful Tables, 9 Color Plates, 9 Charts, Large Octavo, Cloth. An invaluable reference book for oil engineers. New Edition.

LUBRICATION AND LUBRICANTS. By LEONARD ARCHBUTT and R. MOUNTFORD DEELEY. New Fifth Edition, thoroughly revised, enlarged and reset. Most recent developments on the theory and practice of lubrication, explaining new methods to overcome waste energy. 650 Pages. 270 Figures in Text. 163 Tables.

A SHORT HANDBOOK OF OIL ANALYSIS. By AUGUSTUS H. GILL, S.B., Ph.D. Eleventh Edition Revised (1927). The standard short handbook for chemists and engineers.

A TEXTBOOK OF INORGANIC CHEMISTRY. Edited by J. NEWTON FRIEND, D.Sc., Ph.D., F.I.C. Carnegie Gold Medallist. A series of text-books dealing with each branch of inorganic chemistry, written by acknowledged authorities under the personal supervision of J. Newton Friend. Send for complete list and circular.

Just Published:

VOLUME III. PART II. BERYLLIUM AND ITS CONGENERS. By JOSHUA C. GREGORY, B.Sc. (Lond.) F.I.C., and MAY SYBIL BURR, D.Sc. (Leeds). Numerous Diagrams.

VOLUME VII. PART III. CHROMIUM AND ITS CONGENERS. By REECE H. VALLANCE, M.Sc. (B'ham) A.I.C., and ARTHUR A. ELDRIDGE, B.Sc. (Lond.) F.I.C. With Frontispiece and Illustrations.

AUTOMATIC PUMPING. By W. WALKER FYFE. Numerous Illustrations, Diagrams and Tables with Notes on Water Analysis and Filtration.

Write for Circulars and Prices

J. B. LIPPINCOTT COMPANY
PHILADELPHIA

LONDON

CHICAGO

MONTREAL



DAY & ZIMMERMANN

INCORPORATED

Engineers

Design Construction Valuations
Investigations and Reports
Management of Public Utilities

NEW YORK
2 Wall Street

PHILADELPHIA
1600 Walnut Street

CHICAGO
Harris Trust Bldg.

ALAN WOOD IRON & STEEL CO.

MANUFACTURERS OF



PIG IRON



BILLETS, BLOOMS,

SLABS, SHEARED STEEL PLATES,

BLUE ANNEALED SHEETS,

ROLLED STEEL FLOOR PLATES

DIAMOND PATTERN

RIBBED PATTERN

WIDENER BUILDING
PHILADELPHIA, PA.

NEW YORK

BOSTON

DALLAS

SEATTLE

SAN FRANCISCO

LOS ANGELES

AMERICAN PLATINUM WARE

Standard Ware—Made of our specially refined platinum.
Meets the most exacting demands of the laboratory worker.

Complete Catalogue No. 15 on request

AMERICAN PLATINUM WORKS
NEWARK, N. J.

RELIABLE ANALYTICAL CHEMICALS METRIC WEIGHTS

Powers-Weightman-Rosengarten Co.
MANUFACTURING CHEMISTS

New York

PHILADELPHIA

St. Louis

Electrical Testing Laboratories

Electrical Mechanical Photometric Chemical

Acceptance Tests for Purchasers.

Factory Inspections.
Research Facilities.

80th St. and East End Ave.

New York

Engrossing Illuminating Designing

Resolutions, Testimonials, Memorials,
Charters and Penwork of Every
Description :: :: :: :: :: :: :: ::

Commercial Work for Every Purpose

Prices Consistent With Good Work

PENCIL LAY-OUTS FURNISHED

Call, Write or Phone Walnut 7322

FISCHER-GOOD STUDIO

Room 813

H. K. GOOD, Manager

1011 CHESTNUT STREET

Spring Garden Institute

Broad and Spring Garden Streets

SCHOOL FOR TECHNICAL EDUCATION

EVENING CLASSES

Architectural, Freehand and Mechanical Drawing.
Illustration. Machine Shop Mathematics.
Machine Shop Practice. Electricity.
Mathematics. Automobile.

CLASSES OPEN SEPTEMBER 26th

Send for Catalogue.

Phone, Poplar 3106

INSURANCE OFFICE *of* HASELTINE SMITH

Fire, Life and General Insurance

326 WALNUT STREET

PHILADELPHIA



Bell Phone, Walnut 2694 Keystone Phone, Race 1020

GLYNN KOHLER PRINTING CO.

SUCCESSORS TO
BRADLEY PRINTING CO.

"Real Printing Service"

1029-1031 RACE STREET
PHILADELPHIA

High and Low Pressure

**STEAM FITTING
PLUMBING**

JOHN BORDEN AND BRO.
637 North 19th Street

Henry Bower Chemical Mfg. Company

*Yellow
Prussiate
of Soda*



*Anhydrous
Ammonia
Aqua Ammonia*

29th Street and Grays Ferry Road, Philadelphia, Pa., U. S. A.

Journal of The Franklin Institute for March, 1926

The Institute's supply of copies of the Journal for March, 1926, is exhausted. The Editors will be very grateful to any members who do not wish this number for their own files if they will send it to the Institute. Compliance with this request will be very deeply appreciated.

JOURNAL OF THE FRANKLIN INSTITUTE

The Institute has for sale a limited number of copies of the earlier issues and is prepared to supply orders at the following rates:

| | |
|------------------------|----------------------|
| 1824 to 1839 inclusive | Price on Application |
| 1840 to 1859 inclusive | \$2.00 per number |
| 1860 to 1879 inclusive | \$1.50 per number |
| 1880 to 1899 inclusive | \$1.00 per number |
| 1900 to 1915 inclusive | \$0.75 per number |
| 1916 and later | \$0.60 per number |

THE ELECTRON IN CHEMISTRY

BEING FIVE LECTURES DELIVERED AT
THE FRANKLIN INSTITUTE
PHILADELPHIA

By SIR J. J. THOMSON, O.M., F.R.S.

MASTER OF TRINITY COLLEGE AND PROFESSOR OF EXPERIMENTAL PHYSICS
IN THE UNIVERSITY OF CAMBRIDGE

140 Pages, Illustrations, 8vo.

PRICE \$1.75 (Carriage extra.)

Address Orders and Inquiries to

THE FRANKLIN INSTITUTE
PHILADELPHIA, U. S. A.

PAMPHLET REPRINTS OF LECTURES AND OTHER CONTRIBUTIONS

A limited number of reprints of the various papers which appear in the JOURNAL are now on sale. They may be purchased at twenty-five cents per copy.

Complete pamphlets of articles appearing in two or more instalments will be charged for at the rate of twenty-five cents per issue.

Orders and inquiries should be addressed to

THE FRANKLIN INSTITUTE

PHILADELPHIA

JOURNAL OF THE FRANKLIN INSTITUTE

The Institute has for sale a limited number of copies of the earlier issues and is prepared to supply orders at the following rates:

| | |
|------------------------|----------------------|
| 1824 to 1839 inclusive | Price on Application |
| 1840 to 1859 inclusive | \$2.00 per number |
| 1860 to 1879 inclusive | \$1.50 per number |
| 1880 to 1899 inclusive | \$1.00 per number |
| 1900 to 1915 inclusive | \$0.75 per number |
| 1916 and later | \$0.60 per number |

THE ELECTRON IN CHEMISTRY

BEING FIVE LECTURES DELIVERED AT
THE FRANKLIN INSTITUTE
PHILADELPHIA

By SIR J. J. THOMSON, O.M., F.R.S.

MASTER OF TRINITY COLLEGE AND PROFESSOR OF EXPERIMENTAL PHYSICS
IN THE UNIVERSITY OF CAMBRIDGE

140 Pages, Illustrations, 8vo.

PRICE \$1.75 (Carriage extra.)

Address Orders and Inquiries to

THE FRANKLIN INSTITUTE
PHILADELPHIA, U. S. A.

PAMPHLET REPRINTS OF LECTURES AND OTHER CONTRIBUTIONS

A limited number of reprints of the various papers which appear in the JOURNAL are now on sale. They may be purchased at twenty-five cents per copy.

Complete pamphlets of articles appearing in two or more instalments will be charged for at the rate of twenty-five cents per issue.

Orders and inquiries should be addressed to

THE FRANKLIN INSTITUTE

PHILADELPHIA

**RESOURCES
OVER
\$115,000,000.00**

**FIDELITY-PHILADELPHIA
TRUST COMPANY**

326 CHESTNUT ST.

416 CHESTNUT ST.

1431 CHESTNUT ST. - BROAD AND CHESTNUT STS.

6324 WOODLAND AVENUE

Funds Held In Trust, More Than \$600,000,000

